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OF THE

UNIVERSITY OF TEXAS

1915: No. 22

APRIL 15 1915

The Trees of Texas

An Illustrated Manual of the Native and Introduced Trees of the State

BY

Isaac M. Lewis, Ph. D.

Associate Professor of Botany

The University of Texas

Published by the University six times a month and entered as second class matter at the postoffice at

AUSTIN, TEXAS

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The benefits of education and of useful knowledge, generally diffused through a community, are essential to the preservation of a free government.

Sam Houston.

Cultivated mind is the guardian genius of democracy. . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

Mirabeau B. Lamar.

PREFACE

The present bulletin has been prepared to meet the needs of those persons who desire to become more familiar with our native and introduced trees, but who do not have access to the more complete sets of books which treat this subject. It has been my constant aim to avoid the use of technical terms, and only such have been introduced as can be easily learned from the glossary by the amateur student of nature who has had no previous training in botany. The scientific name and the common names most generally in use have both been given for each species. The keys for the separation of families, genera, and species are based, in so far as is possible, on the leaf characteristics. This is necessary for the reason that the leaves remain on the tree throughout the summer, while the flowers soon fall away. We should not be deceived, however, into thinking that leaf characteristics denote natural relationship to the same degree as the characteristics of the flower. It has sometimes been necessary to make use of other characteristics of the tree, such as the fruit, bark, or thorns in order to separate closely related genera or species.

The list of trees herein given has been checked from Sudworth's "Check List of Forest Trees of America", Britton's "North American Trees", and Sargent's "Manual of the Trees of North America." There will doubtless be a number of rare cultivated varieties that have been omitted.

The descriptions are based largely upon herbarium specimens deposited in the herbarium of the University of Texas. The collection of this herbarium material has extended over a period of fifteen years, and has been accomplished by the various persons who have been connected with the School of Botany during that time.

The drawings of leaf characteristics are taken from Gray's "Text Book of Botany" and have been used by permission of the American Book Company to whom the author wishes to express his indebtedness. The photographs for plates 1, 23, 3, 24, 5, are by Professor Wm. L. Bray, formerly Professor of Botany in this University, published by him in his "Forest Resources of Texas", and are here published with his permission. All other line figures have been drawn from herbarium or fresh specimens

by Miss Josephine Huppertz, a graduate student in the School of Botany of the University of Texas. The writer also acknowledges his indebtedness to the various published works of others. The notes of Mr. J. B. Mackenson of San Antonio, on the "Trees of San Antonio and Vicinity" and of Mr. Carl Hartman on "The Trees of Huntsville" have been freely used. The characteristics and uses of the various woods have been based, in part, upon a report of "The Wood Using Industries of Texas" by Hu Maxwell, Expert, and Charles F. Hatch, Statistician of the United States Department of Agriculture, Forest Service, published in the Lumberman's Trade Journal, New Orleans. The arrangement of the groups is essentially that of Engler and Prantl.

ISAAC McKINNEY LEWIS.

University of Texas, School of Botany, February 6, 1915.

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INTRODUCTION

A tree is a woody plant which produces one main central upright axis or stem that does not branch for some distance above the ground. A shrub is also a woody plant, but its stem always branches directly at the ground. Some plants are either trees or shrubs, as, for example, the well known mesquite or the willows.

The tree, as a whole, is an active, living, working being, endowed with all the vital activities peculiar to plants, and sensitive to the physical and biological environment in which it lives. A tree is composed of stem or trunk, roots, leaves, branches, buds, flowers, fruit and seed.

The leaf is an expanded, usually flattened branch of limited growth, consisting of two main parts: the blade or expanded portion, and the petiole or stalk which connects the blade with the shoot. A pair of leaf-like appendages, knows as stipules, are sometimes attached to the petiole. There is a wide variety in shape, size, form and structure of leaves, and it is on these characteristics that the key for the separation of the species is largely based.

The leaf performs three very important functions, namely: photosynthesis, transpiration and respiration.

The word, photosynthesis, means synthesis by means of light. In this process, the green, expanded portion of the leaf, in the presence of sunlight, unites carbon dioxide, which it receives from the air, and water, which it receives from the soil, forming a new compound, carbohydrate, and liberating oxygen, which escapes from the leaf into the atmosphere as a waste product. Thus the green leaf consumes a gas which cannot support combustion or be used in respiration by animals or plants, and releases one which can be so utilized. This explains the purifying effect of green plants on the atmosphere. This process is entirely dependent upon sunlight, and will not take place unless the leaf is properly illuminated. It does not occur any place in nature except in green tissue of plants, and a similar union of the crude materials, carbon dioxide and water to form sugar, has not been brought about, so far, by our most ingenious chemists.

The process of photosynthesis easily ranks as one of the most important of all vital processes, for upon it all life, animal as well as plant, depends. All living substance requires for its nutrition, carbon, for it is one of the essential constituent elements of such substance. But neither plants nor animals are able to utilize crude carbon dioxide as food. It must first be combined chemically with hydrogen to form sugar or starch before it can be so utilized. It is seen, therefore, that plants and animals are alike as regards their food requirements. They differ only as to the manner of procuring food. The plant is an independent organism which is able to manufacture its food from crude inorganic material, while the animal is ultimately dependent upon plants.

It is a well known fact, that when materials containing carbon, as for example, starch, oil, sugar, coal or wood, are burned, carbon dioxide is given off and energy is released in the form of heat. This heat energy was potential in the compound burned. The radiant energy of sunlight enables the green leaf to unite carbon dioxide and water to form carbohydrates, and becomes potential in the compounds formed. Its subsequent release, to do our bidding, depends upon the combustion of these compounds. The energy which furnishes the chief driving power of the world's machinery is energy from the sun, which has been arrested and rendered potential by the green leaves of plants. The coal which warms our homes, cooks our food, and drives our machinery, depended for its formation upon this function of the leaves of plants, which inhabited the earth at that remote age when coal was formed. The heat energy has remained locked up, potential in the carbon compound, awaiting an opportunity to again become kinetic.

The food substances which nourish plants and animals, furnishing them materials out of which their bodies are built, and energy with which to carry on their vital processes, depends upon this ability of the green leaf to unite carbon dioxide and water to form starch and store the radiant energy of the sunlight in a potential form. The release of this energy by a living plant or animal is accomplished by another vital process known as respiration.

If the ability of green leaves to carry on this most important

function in nature depends upon sunlight for its realization, we might well expect to find provision in the arrangement of leaves to facilitate an optimum light exposure.

This expectation is borne out by the facts, and can be easily verified by an examination of the leaves of a few of our native trees with this point in mind. One can not fail to be impressed with the wonderful adjustment by which each leaf on the tree is so placed as to bring it into just the proper exposure to light. Obviously, one of the great difficulties to be overcome is the danger of shading of the lower leaves by those growing above them. The leaf is in its best light relation, on most plants, when its blade is exposed at an angle of about ninety degrees, to the source of light and is free from the danger of being shaded. The exact arrangement of leaves on the stem is a constant characteristic for any plant. In some species the leaves are borne in pairs, one leaf attached on the shoot opposite the other. In this manner of attachment the pairs are arranged in such a way that when looking down on the stem from above there can be seen four distinct rows of leaves separated from each other by greater or less distance, depending upon whether the leaf blade is narrow or wide. In the great majority of trees the leaves are attached singly, and not opposite. This arrangement is called the alternate arrangement, and they are spaced in definite cyclic order upon the shoot in such a manner as to afford sufficient space between the lower leaves and the ones growing above them.

The blades of many leaves are variously cut, toothed, notched, lobed or compounded, and through these openings the light is enabled to filter down to the lower parts of the tree. It is not to be expected that every leaf on a tree can be so placed that it will be in its optimum light relationship at every minute in the day. This would only be possible if the leaf were able to swing about on its petiole and follow the daily march of the sun. When the leaf has reached maturity, its position is relatively fixed and its position with reference to light has been determined by the direction from which it was illuminated during the greater part of the day as it developed. It is, therefore, in the shadow during a part of the time only. Some plants require much more light than others, and many find their best conditions for growth in the subdued light of our deep forests. The shade loving habit of

the ferns, and of many herbs and shrubs, gives us the characteristic ground plants or undergrowth of the woodlands. Trees growing in open situations, where they are equally illuminated from all sides, are usually lower, more bushy topped and symmetrical than members of the same species which grow crowded together in forests. This is to be accounted for by upward growth of the stem, under the stimulus of light from above only. It usually happens, also, that the branches of trees growing close together die away from the older portions, resulting in tall naked stems with a crown consisting of a few branches at the top.

The second important function of leaves is transpiration, or the evaporation of water. The life of the tree depends upon the ability of the leaf to perform this function properly. The amount of water thrown off depends upon the structure of the leaf itself, and upon the physical environment in which the tree grows. The total amount of water transpired by plants is surprisingly great. It has been estimated that an oak tree with seven hundred thousand leaves would give off 244,695 pounds of water from June to October. A birch tree with 200,000 leaves transpired 700 to 900 gallons per day on hot summer days. An acre of such trees would, therefore, transpire 3,168,000 pounds of water in a single season. It is estimated that 200 to 500 pounds of water is transpired in the manufacture of one pound of dry substance. This accounts for the cooling and refreshing effect which vegetation exerts on the atmosphere. It is a well known fact that plants die if they are unable for any reason to take in a supply of water from the roots, sufficient to meet the enormous and continual drain from the leaves. This accounts for the disastrous effects which hot, dry winds exert on many species of plants, and raises the question whether such quantities of water as are ordinarily thrown off are an advantage or a disadvantage to the tree. The opinion is now widely held by botanists, that much greater quantities of water are thrown off by plants than is necessary for the carrying on of their vital activities, and that such great water loss is due to the fact that plants have not fully solved the problem of conserving water. In order for the leaf to carry on the process of photosynthesis, it must of necessity be provided with some means which will permit the entrance of air containing the necessary carbon dioxide, and the

removal of the waste oxygen formed during the process. This is made possible by numerous very small openings in the outer coat of the leaf tissue, known as breathing pores or stomates. It is thru these minute pores that all the gaseous exchanges take place, which make photosynthesis and respiration possible. These openings are therefore necessary for both of these processes. But it is also through them that the water escapes to the outside in the form of vapor, where it evaporates and is lost from the tree. It appears, then, that the functions of the leaf are somewhat antagonistic. It must be aeriated in order to carry on photosynthesis and respiration, but the provision for aeriation is the source of the evil of excessive water loss. It should not be understood, however, that all water loss is a disadvantage. This is true only when it becomes excessive. Doubtless the cooling of the leaf on hot summer days, due to this evaporation of water, keeps the heat from destroying the delicate living substances which compose it.

It is evident that the condition of the soil and air in which the tree grows must determine, to a great extent, the amount of transpiration, since evaporation of water depends directly upon the temperature and the amount of water vapor in the atmosphere.

But the plant itself is not without devices to reduce the loss of water. The breathing pores are principally on the lower side of the leaf, while the upper surface presents, usually, an unbroken covering, which is coated with a waxy substance that does not readily permit the escape of water. Such waxy coverings of the leaf characterize trees which grow in dry situations where the evaporation rate is high, and doubtless have played an important part in fitting these trees to their environment.

The lower side of many leaves is covered with a more or less dense growth of hair-like outgrowths, which also serves to retard the evaporation of water. Such hairy coverings are almost always present on both surfaces of leaves when they first expand from the bud. They frequently remain throughout life or they may disappear with the development of the wax-like, water-proof coat which characterizes the mature leaf.

The size and number of leaves also bears a definite relationship to the environmental conditions. Trees growing in very dry, hot

regions are characterized by small leaves, which do not permit excessive losses of water, while trees growing in warm, moist localities bear numerous large leaves. Some trees bear leaves which are reduced to mere scales, and in some plants, as the cactus, the leaves have entirely disappeared, or have been reduced to small outgrowths known as spines. This is to be explained on the basis of water loss. Such plants grow natively in arid places, where they are fitted by nature to live, and where plants provided with structures which would not insure them against excessive transpiration, could not survive. The distribution of trees is determined largely by their adaptation to water, and this is in turn determined by the root and leaf characteristics.

The third function of the leaf is respiration or breathing. Respiration is a very important vital process which takes place in all living parts of the tree, and is not confined to the leaves alone. Unlike photosynthesis, it does not depend upon light. The gas consumed in respiration is oxygen, and the gas set free is carbon dioxide. It will be seen, therefore, that the plant breathes in exactly the same way as animals, consuming oxygen and liberating carbon dioxide. Respiration is the process in which energy, locked up in foods, is released. It is closely akin to combustion, but the two processes are not identical. The radiant energy from the sun enables the green leaf, in the process of photosynthesis, to decompose the simple inorganic compounds of carbon dioxide and water, and to recombine them into foods which represent a certain amount of stored or potential energy. Respiration breaks down the products of these foods and sets the energy free. Life involves always and continually these transformations of energy. The sun is the source of all life, for it is the source of energy. Photosynthesis utilizes carbon dioxide, and releases oxygen, thus keeping the air pure for breathing purposes. Respiration uses oxygen, liberates carbon dioxide, and sets energy free, and thus makes possible the vital phenomena requiring energy.

The roots of trees constitute the organs of anchorage and absorption. They anchor the tree firmly in the soil and absorb the water and mineral solutions from the soil. The roots are of two kinds, surface and tap, depending on their shape and depth of penetration. It may seem surprising that the roots are able to

absorb such great quantities of water as we have already seen are thrown off by the leaves in transpiration. But the extent of the root system is much greater than we ordinarily suspect, usually equaling or even surpassing in extent the spread of the branches. The roots of tree frequently penetrate the soil to great depths. This is particularly true of trees which grow in very dry soil. The roots of the mesquite are known to attain depths of sixty feet when growing under arid conditions.

The work of absorbing water is carried on by delicate hair-like outgrowths known as root hairs, which form near the tip of the root. These root hairs are fine and delicate, and attach themselves closely to the water-bearing particles of the soil.

Roots of trees are made up largely of woody tissue like the stem, and this enables them to serve as an avenue for the conduction of water as well as to give the trees a firm anchor in the soil.

Roots are sensitive to the pull of gravity, and are also attracted by moisture. The main central or tap root, if growing in soil equally moist on all sides and not hindered by any mechanical obstruction, takes a course straight downward, while the lateral or secondary roots branch out in all directions. Roots usually grow toward moisture. This may be observed along ditches or irrigation canals as well as on the sides of vertical cliffs. The sensitiveness of roots to water, and their ability to grow toward it has been of great advantage to plants. Trees which develop long tap roots are transplanted only with great difficulty. The pecan is a noteworthy example. To offset this difficulty, the tap root on young trees is sometimes cut by nurserymen and a mass of much branched roots of about equal size develops to take its place. The root system must be able to supply the water transpired by the leaves or the tree will die. Accordingly, in transplanting young trees the top should be cut back sufficiently to give the roots time to become established and develop their root hairs.

Roots are very useful in many places because of the binding action which they exert on the soil, thus preventing erosion. Such trees as willows growing along water courses, or the trees of mountain sides and hill slopes, furnish examples of this principle.

The stem may be defined as that part of the tree which bears the roots and leaves and serves as a connection between them.

The water, with its dissolved mineral salts taken up by the roots, passes up through the stem and its branches out into the leaves. The stem responds to the stimulus of gravity and light by growing away from the pull of gravity and toward the light. This response is exactly the opposite to that made by the root, and results in an elongated aerial organ whose chief function is to display the foliage leaves to light. The lateral branches of the stem, like the branches of the root, grow in various directions. The branches may be almost horizontal, drooping, or ascending. In the coniferous trees, such as the pines, the main stem does not branch equally, but extends upward through the crown to the top, and the lateral branches are arranged in regular whorls, which decrease in length from the base to the apex of the stem. Such trees form a more or less symmetrical, elongated, cone-shaped body, which affords the optimum exposure to light. Many of our deciduous trees also exhibit quite regular, conical-shaped crowns. The lombardy poplar, the sour gum, and many species of oak and maple furnish examples. In some trees the main trunk does not extend upward through the crown, but is soon lost and the crown becomes rounded or spreading; the bur oak, the hackberry and the American elm are examples of this type.

In transverse cuts across the stem or any of its branches, four distinct main parts may be observed: the central pith, the woody cylinder, the cambium or growing layer, and the bark.

The woody cylinder consists of a series of annual rings arranged more or less in concentric order. Each ring represents a single season of growth, and by counting the rings the age of the tree in years can be determined with almost perfect accuracy. The ring is made up of two layers, of which the thin, firm layer represents the fall growth, while the more porous large vessels develop in the spring and early summer. It sometimes happens that if growth is checked during the growing season more than one ring is formed, but this can usually be distinguished by careful examination. The outer layer of wood, the sap wood, is usually lighter in color and more readily subject to decay than the central layers or heart wood. This is due to the deposition in the vessels of the heart wood of various secretions which render them impervious to water and exert an antiseptic action on the organism of decay. The sap wood is the chief water-conducting avenue of the

stem, hence trees may be killed by cutting out a ring of this wood entirely around the stem, thus preventing the ascent of water.

The medullary rays radiate from the pith to the bark, and are seen in cross cuts as fine lines of varying widths. In longitudinal cuts, or when the wood is split lengthwise they are seen to be thin plates which differ in structure from the wood proper. The beautiful silver grain of quarter-sawed wood is due to these medullary rays. The rays transport material laterly in the stem and serve as a storehouse for reserve food substance principally in the form of starch.

The cambium is a layer of living tissue which occurs at the outer boundary of the woody cylinder. It is fine and delicate and separates the wood from the bark. It is due to the growth of this tissue that the tree increases in diameter from year to year. The woody cylinder is made up of dead tissues, but the cambium is alive and active, forming new wood on the inside and bark on the outside.

The bark is made up of two distinct layers, an inner and an outer bark. The inner bark is thin, white and fibrous, and has for its function the transport of plastic food substances from one part of the tree to another. If during the growing season the bark is removed just down to the wood, the tree remains alive for the remainder of the season, but dies the following spring. This is due to starvation of the roots, as there is then no way by which food from the leaves or stem can reach them. This principle is frequently made use of in the killing of willow trees and others.

The outer bark is made up of a layer of cork tissue which surrounds the stem and varies in thickness from a very thin papery layer on some trees to several inches in thickness on others. The bark develops from the inside out, and the outside layers are shed and fall away. The method of shedding the bark is quite variable among trees, but is relatively constant for any given species. In some species the bark is tight and smooth, while in others it becomes deeply furrowed or grooved and broken on the surface into smaller scales. The bark of the birch peels away in thin papery layers, the cedars become shreddy, while some of the hickories form large shaggy plates. An experienced

forester can usually determine the species of tree by the bark characteristic alone.

The function of the bark is to prevent loss of water and to protect the delicate inner living tissues from the entrance of parasitic fungi and bacteria which would lead to the decay and death of the tree. Injuries which break the continuity of the bark are the most frequent causes of diseases of trees. The gnawing of the bark by horses is one of the serious menaces to street shade trees, and they should always be protected against it. The bark forms a very effective protective layer which, if uninjured, usually suffices to keep most trees in a relatively healthy condition. It is, however, provided on young portions with openings which are necessary to furnish a means for aerating the stem. These openings are known as lenticels, and they furnish an unavoidable avenue for loss of water and for the entrance of fungi and bacteria.

A bud may be defined as an undeveloped shoot. The formation of buds takes place during the active growing season, which in our latitude lasts until the middle or latter part of July. After this time the tree continues to manufacture food and store it up in the buds and other organs until September or October, when a period known as the winter rest period begins. This lasts until the following spring, when the buds expand into leafy or floral shoots. This rhythmic periodicity in the life of the tree is directly due to the change of the season from conditions favorable to growth to conditions unfavorable.

The bud contains, in miniature form, the leaves or flowers which will appear the next year. These structures are very small, yet all the parts are present. The outer part consists of a series of leathery, scale-like leaves which overlap each other and protect the delicate inner parts from injury. It is a popular notion that the enveloping bud scales serve as a protection against cold and keep the inner parts from freezing during the cold winter. But this is not the case. There are in plants no provisions for maintaining a body temperature higher than that of the surrounding air, and there is no cold so intense that it could not be endured by many plants if this were the only unfavorable factor. The bud scales serve primarily as a protection against loss of water, for which purpose they are well fitted. The mucilaginous or

resinous material with which the scales are cemented together renders them almost water-proof and prevents the escape of water at a time when none could be obtained from the soil. In the spring, however, after the buds have begun to open, they are readily killed by freezing, for this draws the water out of the delicate inner parts, and the protection against loss of water having been now lost, the bud dies of dessication when the ice melts.

Buds may be grouped into various classes on the basis of structure, position on the stem, parts included, and time of development.

As a rule, buds are borne singly in the axils of the leaves; at the end of the stem or its branches; or directly underneath the petiole of the leaf. The bud may contain foliage leaves, flowers, or in some cases both. Many buds, because of their location, fail to develop and are known as dormant buds. They usually die within a few years, but in some cases they remain alive and become covered over with layers of wood, under which they grow slowly and maintain themselves near the surface of the wood. These buds, growing and branching in the wood, produce the curling and twisting of the grain, which is known as "bird's-eye" wood.

The dormant buds may begin to develop at any time, provided they are favorably located and supplied with sufficient food. This condition arises when part of the tree is broken or cut away and the young shoots that develop come largely from dormant buds. Buds may also arise at any time from the stem, root, or even the leaves. These are called adventitious buds. The frequent suckering of many plants from the roots is due to these adventitious buds, as is also the growth of sprouts from the stumps of hardwood trees.

The rapid unfolding of buds into leaf and flower is ever a constant source of pleasure, for it marks the transition from dormant to active life. It involves all the changes which take place in the great awakening of nature from its long winter sleep period, and inspires within us hopes of a promise to be fulfilled in leaf, flower and fruit.

The flower may be defined as the forerunner of a seed. All of our trees, when they have reached a certain age, bear flowers and develop seeds. It is this characteristic which enables each

species to perpetuate itself and to become distributed over the earth.

In the typical, complete flower, four sets of organs are present: the calyx, the corolla, the stamens, and the pistil. The calyx is the outer whorl of leaves, usually greenish in color, which, before the flower opens, functions in much the same manner as the bud scales, preventing the delicate inner parts from suffering injury due to water loss. The calyx is composed of several separate leaves known as sepals. The corolla is the showy colored part of most flowers, and is made up of a number of colored leaves, petals, which may be entirely separated from each other, or in some cases are more or less united at the base. The stamens, several in number, are usually separate, filamentous structures which bear an enlarged body at the upper end known as an anther or pollen case. Their function is to produce the pollen. The pistil consists of three parts: the ovary or basal enlarged portion which is usually somewhat inflated and bears the ovules or young seeds; the style, a filament about the size of the stamens and growing up to about the same level with their tops, or sometimes projecting beyond them, and the stigma, or the swollen expanded end of the style.

The stamens and the pistil are the essential parts of the flower, while the calyx and corolla are known as the accessory parts.

When the flowers are fully developed the anther case breaks open and the pollen is shed from it. In order for a seed to be formed, some of this pollen must fall upon the stigma and develop into a long burrowing tube which grows down through the style into the ovule or young seed. This is known as the pollen tube, and each ovule must receive such a tube or die. The pollen tube is microscopic in size and bears the male reproductive, or sperm cells. Inside the young seed or ovule, the female reproductive cell, the egg cell, is borne. The pollen tube penetrates the opening to the ovule and delivers the male cell to the female. These two cells then fuse completely into one. This process is known as fertilization, and the embryo plant develops from the fertilized egg cell. The embryo plant with the tissue surrounding it is called the seed.

Of all the processes carried on by plants, the method by which a seed is formed is perhaps the most striking and interest-

ing. It is the device by which perpetuation is insured. The chief problem of each organism that lives is to maintain its existence during life and to leave others like itself when it dies. The flower then is the structure upon which the perpetuation of the species depends and toward which all the energy of the tree is directed. The mightiest trees which today inhabit the earth began life, some of them, perhaps eight thousand years or more ago, when the pollen tube delivered its sperm cell to the egg cell in the young ovule. For in this way, and this way only, can a new individual originate.

The transfer of pollen from the anther to the stigma is known as pollination. When the pollen is borne on one flower and the stigma on another, the process is known as cross-pollination; but if they are produced in the same flower it is called self or close pollination. Perhaps the great majority of plants favor cross-pollination, for there are many evidences in support of this theory. In many plants the flowers are incomplete; that is, some flowers bear only stamens while others bear only pistils, and in some plants these two types are borne on separate individuals. Such plants are called dioecious.

Cross-pollination is brought about through the agency of the wind, water and insects. Wind pollenized flowers are usually small, consisting only of the essential flower parts, while those which are visited by insects are usually larger, more showy and produce nectar and odor. The relationship which exists between insects and flowers is one of the most interesting chapters in biology. The insect and the flower have evolved together, and they perform for each other a mutual service. The insect visits the flower in order to procure food, but while there its body becomes dusted with pollen, and this is transferred to other flowers which it then visits. The pollen of one species will grow only upon the stigma of the same or of a closely related species. This tends to keep each species pure. However, crossing may occur provided the pollen of one species is carried to the stigma of another that is closely related to it. This has led to the improvement of many of our cultivated varieties of plants as well as to the origin of entirely new hybrid varieties.

Flowers are either borne singly on the stem or in clusters. When the flowers are solitary, they are either on short lateral

shoots in the axils of leaves, or at the end of the main axis of the shoot. Flowers which occur in clusters may be grouped for convenience into a number of definite types. A *raceme* of flowers or fruits is an arrangement of the individual flowers on the more or less elongated axis, each with a separate pedicel, all about equal in length. A *panicle* is a flower cluster in which the simple pedicels of the raceme become branched and spreading. A *corymb* is also like the raceme, but in this case the flower shoot is shortened, and the lower pedicels are longer than those borne above them, so that the clusters become flat topped with all the flowers borne at about the same level. A *cyme* resembles a corymb, but in this case the pedicels become branched and the central flower blooms first. An *umbel* is a flower cluster in which the pedicels of the flowers start from the same point and become about of equal length. A *head* is a cluster in which the axis is very short and the flowers are without pedicels, or nearly so, forming a globose or compressed cluster. A *catkin,* or ament, is a long, slender, drooping axis which bears numerous solitary sessil flowers in the axils of bracts, the whole cluster falling away after the maturity of the flowers. Among trees, the willows, poplars, oaks, and birches bear their flowers in catkins.

A flower has been defined as the forerunner of a seed; but plants bear their seeds in some kind of a structure known as a fruit, consisting of the ripened ovary, and sometimes other accessory parts. The fruit is a structure which aids in the distribution of seeds. Fruits are either dry or fleshy. Dry fruits may be grouped under two heads: those which open and shed their seeds at maturity are dehiscent, those which do not open are indehiscent. Of the indehiscent fruits, our commonest examples among the trees are the samara or the dry winged fruits of maples, elms, ash, ailanthus, hop tree, etc.; the acorn of the oaks; the nut of the walnut and hickory. The dry dehiscent fruits are known as pods if the seeds are fastened along one side and there is but a single cavity, otherwise they are called capsules.

Among the fleshy fruits our commonest examples are the berry, pome, and drupe. The term berry may be used to denote all fleshy fruits with more than one seed buried in the mass of pulp. The pome or apple fruit differs from the berry by bearing the seeds inclosed by a hardened substance. The drupe is a single-seeded fleshy fruit.

DISTRIBUTION OF TREES IN TEXAS

Within the wide domain included by the boundaries of Texas, the natural conditions which go to determine the distribution of trees are extremely varied in character. The chief factors which have influenced distribution are rainfall, character of the soil, temperature, light and winds. Of these the first two are by far the most important.

The factor which more than any other dominates the distribution is rainfall. This is shown by the transition which takes place in the character of the tree flora from the moisture-loving species of the eastern part of the state to the drought-resistant varieties of the west.

A map of Texas constructed to show the difference in annual rainfall for each degree of longitude divides the state into nine zones differing from each other by five inches of rainfall and extending in a general north and south direction across the state. The first of these zones receives an annual rainfall of more than fifty inches, and in this zone the trees reach their maximum size and abundance. The second, with forty-five inches, extends to the ninety-sixth meridian, the third, with forty inches, extends to the ninety-seventh, and so on to the one hundred and second, where the rainfall is fifteen inches. These zones, passing from north to south across the state, include a wide variety of soil types and physiographic features, which have, to a certain extent, modified the character of the vegetation. In order to understand fully the factors which have influenced the distribution of trees in any area, it is necessary to consider the quality of the soil, the physiographic features and all the climatological factors.

The trees which inhabit the eastern part of the state are extensions of the forests of the Atlantic and gulf coastal plains, as well as some from the Middle and North Atlantic States. These trees are all adapted to abundant rainfall and become checked near the Brazos River by the dry climate of the Southwest. Concerning the further westward extension of this forest area, Bray says: "Here its vanguard is broken into straggling detachments of which only the hardier varieties push onward along the prairie streamways or up the deeper canyons of the hills. It is a striking phenomenon this breaking and gradual dwindling away of so vast and vigorous a forest. Not only in

Texas, but far to the north, through Indian Territory, Kansas, Nebraska and the Dakotas, the same thing may be seen. Like a vast wave that has rolled in upon a level beach, the Atlantic forest breaks upon the dry plains—halting, creeping forward, thinning out, and finally disappearing, except where along a river course it pushes far inland."—Forest Resources of Texas.

The trees of central Texas are made up of these last straggling remnants of the mighty forests of the eastern states; some species which have reached into it from Mexico and the Rocky Mountains, together with others which are not found in any other part of the world and may be regarded as its own peculiar product. Central Texas is, therefore, the meeting ground for the outposts of three great forest areas, and is peculiarly rich in the variety of its tree flora.

The trees of the Southwest and West are principally species which have a wider distribution into Mexico and the Rocky Mountains.

INFLUENCE OF FORESTS ON CLIMATE, RUN-OFF AND EROSION

The chief value of forests is as a source of timber, but in many parts of the world they exert other influences which are of the utmost importance. The chief subsidiary value of the forest is in its relation to the climate, run-off, and erosion.

The influence of forests on climate is chiefly to render the atmosphere more humid, to modify the radiation of heat, and check the winds. It is a popular belief that forests exert an influence on the amount of rainfall over a given area, but this theory has not been substantiated by any experimental data. It is very doubtful if forests influence in any way the actual amount of precipitation. They do, however, exert a profound influence on the retention of water, thus controlling run-off and erosion.

In the forest the heavy rain, as it falls, is checked by the branches and leaves of the larger trees, particularly when they are in full leaf. From these the water drips to the smaller trees and undergrowth and then to the carpet of leaves below. Here it is held in great quantities and slowly percolates into the humus soil, which is also able to hold many times its own weight of

water. In this way long continued heavy rains are required before the excess water begins to flow off into streams and rivers. The water which percolates down into the soil gradually runs away to feed streams and springs, and thus maintains their steady flow throughout the year. It is a very noticeable fact that springs are much more common in forested lands than in the open, and that they usually cease to flow when the forest is removed. The water-holding power of a watershed is much greater if it is covered with timber than with any other vegetation, but grassy plains catch and hold much more water than cultivated areas. The removal of forests, and the cultivation of the areas once occupied by them, has given rise to the various floods which now occur on many rivers throughout the country. Concerning erosion, it has been estimated that 1,000,000,000 tons of sediment are annually pouring into the seas from the rivers of the United States. This material is derived from the surface layers, the richest part of the soil, and its land value, the annual loss, would exceed all the land taxes of the country. The soil actually removed does not, however, constitute the entire danger. The surface of the hillside areas frequently become so gullied that they can no longer be tilled, and all productive power is lost.

SHADE TREES

Aside from their more readily estimated value for fruit, timber, and fuel, trees are valuable for shade and ornament. The ornamental shade tree ministers not only to our physical comfort, but also to the aesthetic pleasures which come to us through a perception of beauty. The chief value of trees for city streets, lawns, and parks is due to the beauty which can be developed by their use. It is a value not always appreciated by all, and one which should be enhanced by education.

There is a growing sentiment throughout the country in favor of the planting and care of shade trees. In the past, each owner has planted along his property such trees as he saw fit, and given them such attention as his knowledge and circumstances permitted. This has resulted in miscellaneous collections of trees, devoid of design, harmony and adaptation of means to an end—the very principles upon which beauty depends.

In many of the cities of this country the work of planting and

care of trees for streets and parks has been placed under the supervision of an experienced official, who superintends the work for the entire city. This method is bringing about much better results, and is to be recommended wherever practicable. Every city should take some action to encourage more uniformity in the matter of planting trees. Trees for any given street should be of the same variety, equally spaced, planted the same distance from the sidewalk, pruned to the same height and kept in a healthy condition. They should be free from the ravages of horses' teeth, the old-time "tree pruner," the merchant's sign poster, and the telephone lineman—the worst pests of street trees.

A city with beautiful avenues, lined on either side with such trees, possesses an asset of almost inestimable value, for it contributes to the happiness and civic pride of all its people and hence elevates the tide of life through an appreciation of the beautiful.

Trees for parks should represent all the varieties possible in as nearly as practicable their natural forest habits. A native wooded park is an asset which no city or town can afford to consider lightly. One of the most delightful spots in all Texas is to be found in beautiful Brackenridge Park of San Antonio. This fine tract of native woodland, generously donated to that city by Mr. George W. Brackenridge, will become a priceless heritage as the years go by. If the wishes of the former philanthropic owner and lover of nature are observed, it will never be defiled by ax or saw, but will remain forever to inspire in the hearts of men a love and reverence for the passing things of wild free nature, as they come down to us undefiled by the hand of man. What better gift could be bestowed by any philanthropist than this, and what better precedent might be followed by others.

THE NAMES OF PLANTS

Plants, like everything else, are given names by which they may be designated. We recognize plants both by common and scientific names. The common name of a plant is the name by which it is known locally, and frequently differs in various sections of the country. The co-called Texas long leaf pine of East Texas becomes the Georgia pine further east. In fact, this one pine is known by as many as thirty different common names in

different parts of its range. The scientific name of a plant is given to it by the individual who first describes the species, and the name of the species is usually followed by the name of the man who described it. For example, Quercus alba L. means that this plant was originally described by Linnaeus and given the name Quercus alba. No other plant is known by this name. Scientific names should be used more extensively by all in designating plants, for it is only through this means that we are able to know with certainty that reference is made to a definite species. The name of a plant consists, usually, of two parts or words, as, for example, Prosopis glandulosa, Pinus palustris, Ulmus Americana, Quercus nigra. The first of these words indicates the *genus* to which the plant belongs, and is always capitalized, the second indicates the *species* and is only rarely capitalized.

The classification of plants is an attempt to express their actual kinship, or what we are accustomed to know as blood re lationship. Each kind of plant is known as a species. A species consists of a group of individuals which resemble each other more than they resembleany other individual. For example, all of the trees which we call Ulmus Americana are more like each other than they are like any other group of trees. Then there are groups of species which are more like each other than they are like any other species. Such a group is known as a genus. There are in our area four species, all of which are more like Ulmus Americana than they are like any other species, but each differs from it and from each other in certain essential characteristics. These species are Ulmus Americana, Ulmus alata, Ulmus crassifolia and Ulmus fulva. The name of the species consists of the generic name which denotes the genus, and is followed by the specific name which defines the species. But the genus and species is not the complete expression of the relationship of any given plant. There are groups of genera which resemble each other more closely than they resemble any other genera. Such groups are known as families; for example Ulmus (elms) and Celtis (hackberry) make up the family Ulmaceae. Families are likewise grouped into orders, and these in turn into larger groups.

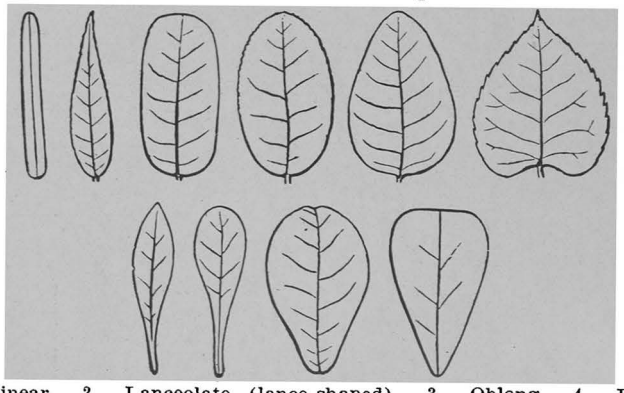
It should be borne in mind that, knowing the name by which a plant is designated marks only the beginning of an acquaint-

anceship with it. It serves merely as our introduction. An intimate acquaintance depends on a knowledge of its distribution, family relationship, characteristics, soil and water requirements, products, economic or horticultural value—in short, all that may be learned about it. The writer hopes that no one will be found who retains the hopeless attitude that to know more about plants causes a lessening of our appreciation of their beauty.

HOW TO USE THE KEY

The number of species which occurs in our tree flora is so great that descriptions alone would not enable the beginner to determine the name of a tree without long and tedious effort, which in the end would frequently prove uncertain. Accordingly, the key has been arranged in such a way that if followed step at a time the investigator may arrive at the proper description with relative ease and accuracy. Suppose, for example,

I. Outlines and Bases of Simlpe Leaves.

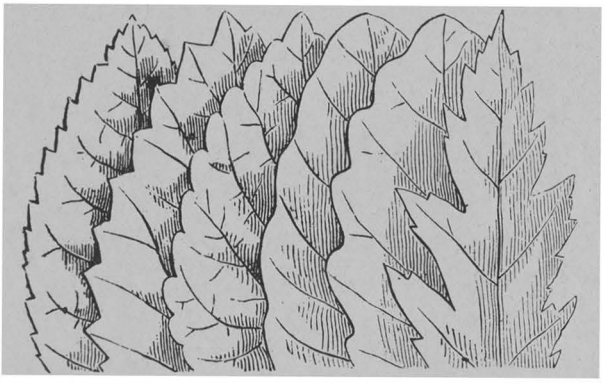


1. Linear. 2. Lanceolate (lance-shaped). 3. Oblong. 4. Elliptic. 5. Oval. 6. Ovate (egg-shaped). 7. Oblanceolate. 8. Spatulate (spatula-like). 9. Obovate (reversed ovate). 10. Cuneate (wedge-shaped).

one wished to find the name of the American elm. The first choice to be made is between "leaves needle, scale or awl-like; fruit a cone of dry scales or a berry-like cone," and "leaves with expanded blades, fruit not as above." This choice is easily made in favor of the latter. Under "I," leaves compound, or "II," leaves simple, the beginner will find it necessary to consult the glossary and illustrations to determine just what is meant by

these terms, when his decision will be in favor of "II." Then he must determine whether the leaves are opposite or alternate on the stem. Here his decision goes to "B," leaves alternate. Under "B," the choice goes to "2," leaves with "netted veins," then to "b," "leaves with only one primary vein at base." The next choice is between "leaves entire and blade of leaf serrate or notched," "(1)" or "(2)." In this case the second is found correct. After this the choice falls on "(a)," "veins of leaves straight," not prominently branched then "y." Trees not thorny

II. Leaf Edges.



1. Serrate (saw-toothed). 2. Dentate (toothed). 3. Crenate (scalloped). 4. Undulate (wavy). 5. Sinuate (bayed). 6. Incised (jagged).

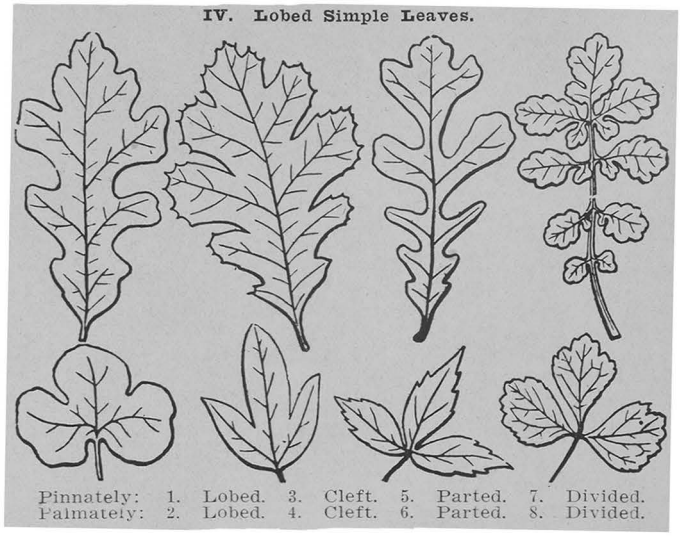
and finally "(x)" leaves oblique at base, and "m" fruit a circular samara, leaves harsh to the touch. This leads unerringly to the genus Ulmus, and no other tree in our flora can be placed here if the observations are carefully made and each decision accurately drawn. Turning to the page reference a descrip-

III. Leaf Tips.

1. Acuminate. 2. Acute. 3. Obtuse. 4. Truncate. 5. Retuse. 6. Emarginate. 7. Obcordate. 8. Cuspidate. 9. Mucronate.

tion of the genus is given. Here again the student should check each statement in the description, to see if it tallies with the specimen at hand. If correct, the key to the genus must next be consulted. Here the choice goes to "flowers opening in the spring before the leaves." "Branches not corky winged." "Leaves smooth or somewhat roughened above, inner bark not mucilagin-

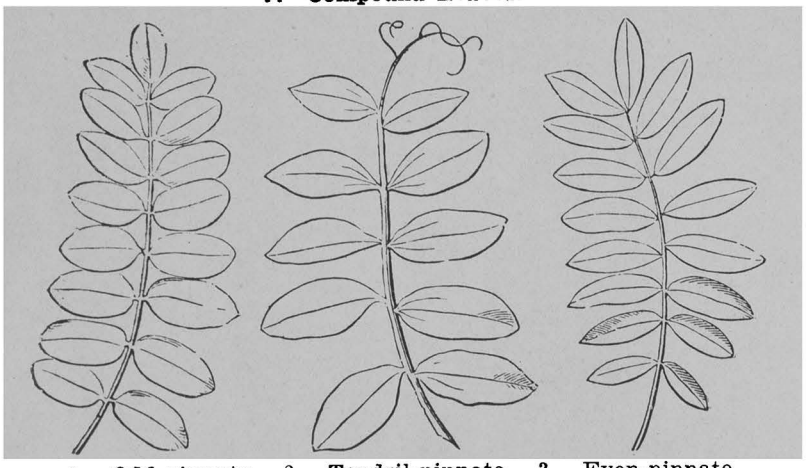
ous." The determination is then checked by turning to the description of the species and consulting the illustration. If the pine is taken, the first choice goes to "leaves needle scale or awl-



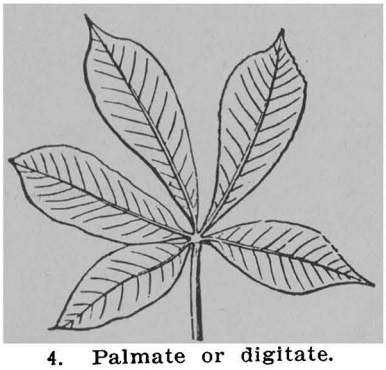
shaped," etc., which leads to the family Pinaceae. Here the decision is between "leaves all needle-shaped" and "leaves scale-like and appressed to the stem, or some of them awl-shaped, spreading." If the leaves are needle-shaped and borne in clusters of two to five, the species goes to the genus Pinus.

It is believed that practice in the use of the key will soon enable one to locate the family, genus, and species with almost certain accuracy. It must be borne in mind that accuracy of observation is necessary to its successful use.

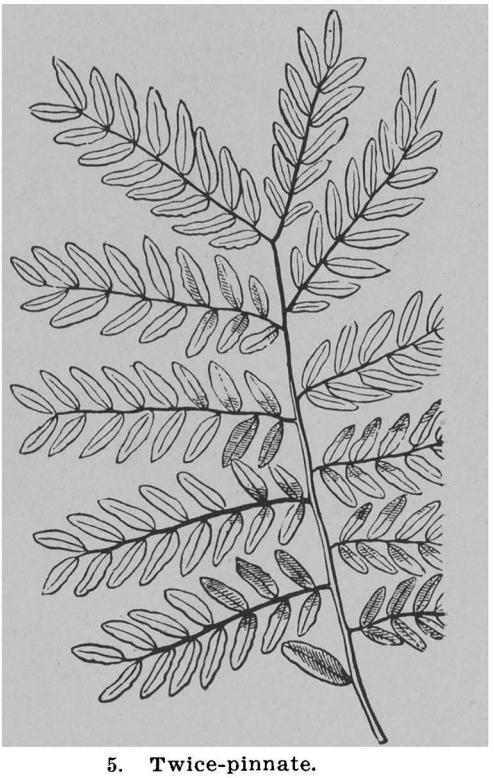
V. Compound Leaves.



1. Odd-pinnate. 2. Tendril-pinnate. 3. Even-pinnate.



4. Palmate or digitate.



5. Twice-pinnate.

A KEY TO THE TREES OF TEXAS

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Leaves needle, scale, or awl shaped; fruit a cone of dry scales or a berry-like cone.....Pinaceae 33

Leaves with expanded blades; fruit not as above.

I. Leaves compound.

A. Leaves palmately compound.

1. Leaflets 5 to 8.....Aesculaceae 132
2. Leaflets 3.....Ptelea in Staphyllaceae ..126

B. Leaves pinnately compound.

1. Leaves once pinnate.

a. Leaves without an odd leaflet at the end, opposite, persistent.....Zygophyllaceae .125

b. Leaves with an odd leaflet at the end.

(1) Leaves alternate.

(a) Leaflets toothed or notched all the way around.

x. Trees with thorns.....Fagara in Rutaceae 125

y. Trees thornless.

(x) Fruit red drupes...Schmaltzia 129

(y) Fruit a nut.....Juglandaceae ... 47

(z) Fruit a trilobed capsule .....Ungnadia in Sapindaceae 138

(b) Leaflets entire.

x. Trees with thorns.....Fabaceae 121

y. Trees without thorns.

(x) Fruit yellow drupes borne in clusters....Sapindus 138

(y) Fruit an elongated pod .....Fabaceae 121

(c) Leaflets with one to four gland tipped notches at base .....Ailanthus 127

(2) Leaves opposite.

(a) Leaflets, three evergreen...Heletia in Rutaceae 125

(b) Leaflets 3-5, lobed or doubly serrate, fruit winged .....Aceraceae 134

(c) Leaflets 5-11, sharply serrate, fruit clusters of drupes .....Sambucus 157

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(2) Blades slightly serrate above the middle, drupes elongated.....Adelia 153
(3) Blades serrate, fruit a four-lobed capsule with bright red seeds.....Euonymus.....132

B. Leaves alternate.
1. Leaves parallel nerved, crowded at the end of single or sparingly branched stems. Palms and Yucca 46
2. Leaves with netted veins.
a. Leaves with more than one primary vein at base or the lower veins longer and more branching than those above them.
(1) Blade of leaf entire.
(a) Primary veins three, base of leaf oblique, fruit a drupe....Celtis 98
(b) Primary veins five to seven, base of leaf heart-shaped, fruit an elongated pod.....Cassiaceae 118
(2) Blade of leaf serrate or notched.
(a) Leaf broadly heart-shaped.
x. Oblique at base, sap watery, fruit a winged nutlet.....Tilia 140
y. Not oblique at base, sap milky, fruit a berry, leaves frequently lobed.
(x) Berry edible, leaves not hairy.....Morus 88
(y) Berry not edible, leaves hairy.....Broussonetia ... 92
(b) Leaf not at all heart-shaped, the base decidedly oblique, fruit a drupe.....Celtis 98
(c) Leaf blade deltoid, or sometimes heart-shaped, buds gummy, petiole usually flattened .....Populus 55
(3) Blade of leaf lobed.
(a) Plant quite thorny, fruit terminated by the spreading calyx .....Crataegus 105
(b) Plant not thorny.
k. Leaf star-shaped, lobes 5-9 serrate .....Liquidambar ...101
l. Leaf large with 3-5 irregular lobes, petiole of leaf covering the young buds, fruit a globose head of achenes .....Platanus 104

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m. Leaves aromatic, entire, or 2-3 lobed.....Sassafras 142
n. Leaves 5-7 lobed, juice milky .....Ficus 92
o. Leaves 3-5 lobed, the lobes blunt pointed, fruit a leathery capsule opening before maturity, bark smooth .....Firmiana 141

b. Leaves with only one primary vein at base.
(1) Blade of leaf lobed, fruit an acorn.Quercus 63
(2) Blade of leaf entire.
(a) Leaves long, more than six inches.
x. Fruit a banana-like structure, flowers opening before or with the leaves, leaves broadest above the middle, emitting a foetid odor when crushed.....Anonaceae 102
y. Fruit a cone-like body, flowers opening after the leaves .....Magnoliaceae ...103
(b) Leaves less than six inches in length.
x. Leaves evergreen.
(x) Bark and leaves aromatic .....Lauraceae 141
(y) Bark and leaves not aromatic.
(x) Fruit and acorn, leaves sometimes serrate on young twigs .....Quercus in Fagaceae 63
(y) Fruit a black drupe with thick skin, leaves leathery, pointed at the apex.....Laurocerasus ...113
y. Leaves deciduous.
(x) Leaves scale like.
(x) Trees with thorns.Koeberliniaceae 125
(y) Trees without thorns.Tamaricaceae ..141

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(y) Leaves not scale like.
  (x) Trees more or less thorny.
    m. Fruit black, drupe-like berry, sap milky, thorns sometimes at ends of branches....Bumelia 148
    n. Fruit orange-like, sap milky .....Toxylonn 92
    o. Fruit a drupe, ¼ inch in diameter, leaf blades leathery, spatulate.Condalia 139
  (y) Trees not thorny.
    m. Leaf blade thin, oval in outline, veins prominently curved, fruit a drupe .....Nyssaceae 143
    n. Leaf blade thin, with blunt rounded apex, fruit small drupes, borne in terminal panicles.Cotinus 128
    o. Fruit a berry with thickened calyx.
      (m) Berry 1-½ inches long, yellow .....Diosyporys 148
      (n) Berry ½ in. long, blueblack.Brayodendron .147
    p. Fruit a pod, leaves linear...Chilopsis 156
    q. Fruit a blunt two-celled capsale 1-16 inch long .....Cyrillaceae 130

Page

r. Fruit an elliptic drupe about one inch long ..... Leitnera 53
s. Leaves thick, fruit an acorn. Quercus 63

(3) Blade of leaf serrate or notched.
(a) Veins of leaves straight not prominently branched.
x. Trees with thorns, fruit a pome ..... Crataegus 105
y. Trees without thorns.
(x) Leaves oblique at base, fruit a circular samara, leaves harsh to the touch ..... Ulmus 94
(y) Leaves not oblique at base.
m. Leaves rounded or somewhat heart-shaped at base 1-2 ½' long, thick; fruit a globular drupe ¼ inch in diameter ..... Planera 97
n. Leaves thin, buds long sharp pointed, bark smooth, fruit a bur with two triangular shaped nuts ..... Fagus 62
o. Leaves thin, the bark of the trunk peeling off in thin papery leaves..... Betula 61
p. Leaves thin, flower in catkins, fruit hop-like ..... Ostrya 59
q. Leaves thin, fruit a catkin with large leaf like bracts. trunk of tree grooved ..... Carpinus 60
r. Leaves thicker than the preceding, fruit an oval shaped woody cone..... Alnus 61

Page

q. Seeds of fruit with cotton hairs, leaves at least three times as long as wide.....**Salix** 56
r. Fruit a black, many seeded berry.....**Batodendron** ...147
s. Fruit small, yellow, globose drupes, the size of a pea.....**Ehretia** 154
t. Fruit a yellowish green pome .....**Malus** 105

PINACEAE. The Pine Family.

Trees with a resinous juice; leaves linear or scale-like, clustered, or borne alternately on branches, mostly evergreen; fruit a dry cone, or sometimes a berry. A family with about 250 species distributed throughout the world, but confined principally to temperate regions. They are of great economic importance as a source of resin, tar, turpentine and pitch as well as for lumber and ornamental planting.

Leaves all needle-shaped.
- Leaves borne in clusters of two to five..... 1 Pinus.
- Leaves scattered on the stem.
  - Leaves deciduous..... 2 Taxodium.
  - Leaves evergreen..... 3 Pseudotsuga.

Leaves scale-like and appressed to the stem, or some of them awl-shaped, spreading.
- Fruit a small cone consisting of a few scales:
  - Cones ovoid to oblong..... 4 Thuja.
  - Cones globose..... 5 Chamecyparis.
- Fruit fleshy, berry-like.
  - Leaves awl-shaped, spreading on mature branches, cones axillary..... 6 Juniperus.
  - Leaves scale-like, appressed on mature branches, cones terminal..... 7 Sabinia.

1. **PINUS.** The Pines.

Monoecious, evergreen trees or rarely shrubs of great economic importance. The leaves are borne in clusters of two to five upon minute dwarf branches. The main stem produces branches regularly in whorls which decrease in length towards its apex, thus giving the tree a conical appearance. Flowers borne in the spring; the fruit, a woody cone, not ripening until the season following. The seeds are borne in pairs at the base of the cone scales.

Leaves in 5's with a deciduous sheath at base, cone scales unarmed..... 1. P. flexilis.

Leaves in bundles of three.
- Cones subterminal, cylindrical or conical—oblong, slightly curved, armed with small reflexed prickles..... 2. P. palustris.
- Cones lateral, ovate-oblong, armed with short, stout prickles..... 3. P. taeda.

Leaves in bundles of two or three.
- Cones oval to oblong-oval; scales without prickles; leaves short, ¾' to ¼' long.... 4. P. edulis.
- Cones subterminal, 5'-15' long; scales armed with stout prickles..... 5. P. ponderosa.
- Cones lateral, conic, 1½'-2½' long..... 6. P. echinata.

Leaves in bundles of two; cones ovoid to globose; spines short or none..... 7. P. glabra.

1. Pinus Flexilis James. Rocky Mountain White Pine. Bull Pine. Limber Pine.

A round topped tree reaching a maximum height of 40°-50° and trunk diameter of 2°-5° with short trunk, stout branches, and thick fissured bark. Leaves borne in clusters of five, about 1½'-3' long, stout and stiff. Cones 3' to 10' long. Wood soft, close grained.

Alberta southward to southeastern California and western Texas, extending into the Guadalupe and Limpia mountains.

The wood belongs with the yellow pines. It is soft and easily worked, but the trees of our area are too small to be of much value for timber.

2. Pinus Palustris Mill. Long Leaf Pine. Texas Long Leaf Pine. Texas Yellow Pine.

A large forest tree with a maximum height of 100°-120° and trunk diameter of 2°-3° with narrow crown and thin, scaly, orange brown bark. Leaves bright green, soft, and flexible, sharp tipped, 8' to 18' long, borne in clusters of three with a sheath at base. The cones are almost sessile, cylindric, or oblong, 6'-10' long, frequently slightly curved. The scales are thin, flat and armed with a small reflexed spine.

Southeastern Virginia to Florida and along the Gulf coast through Louisiana to Texas. It grows in sandy soil and is not common in river valleys. In Texas it extends to the Trinity River.

The wood of this pine is stiff and hard, possessing great strength. It is much used in the central and eastern part of the United States as bridge wood. It is also well adapted for frames, and trusses for large buildings. Large quantities of this wood are employed for flooring and car building. In addition to the wood, it yields valuable naval stores, such as rosin, pitch, turpentine, and oils. The forests of the older

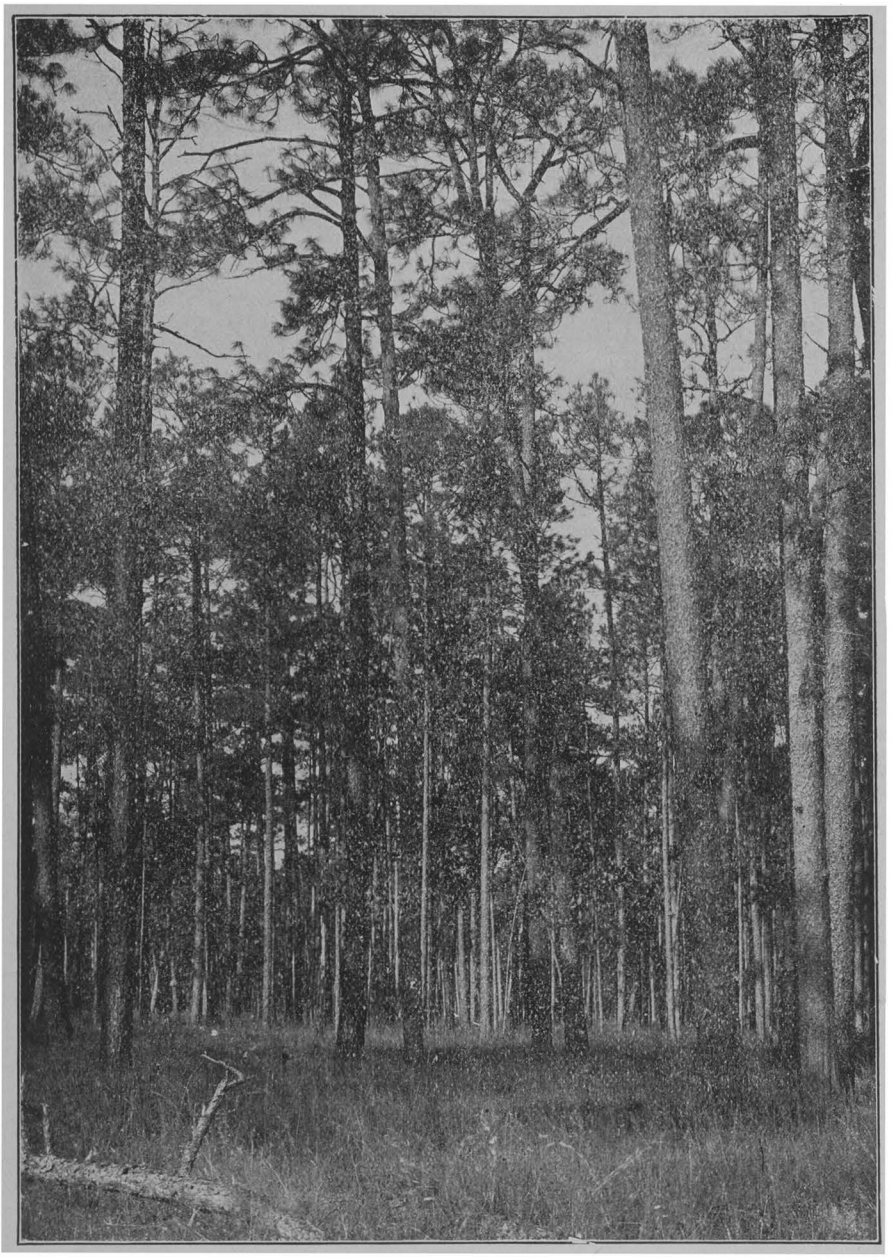


Fig. 1. Long leaf pine forest in East Texas. (Bray Bulletin 47 U. S Dept. of Agr.; Bureau of Forestry.

Gulf States have been largely depleted of this fine wood and the supply in Texas will be exhausted in a few more years.

3. Pinus taeda L. Loblolly Pine. Old-field Pine.

A large, round topped, forest tree with straight, tapering

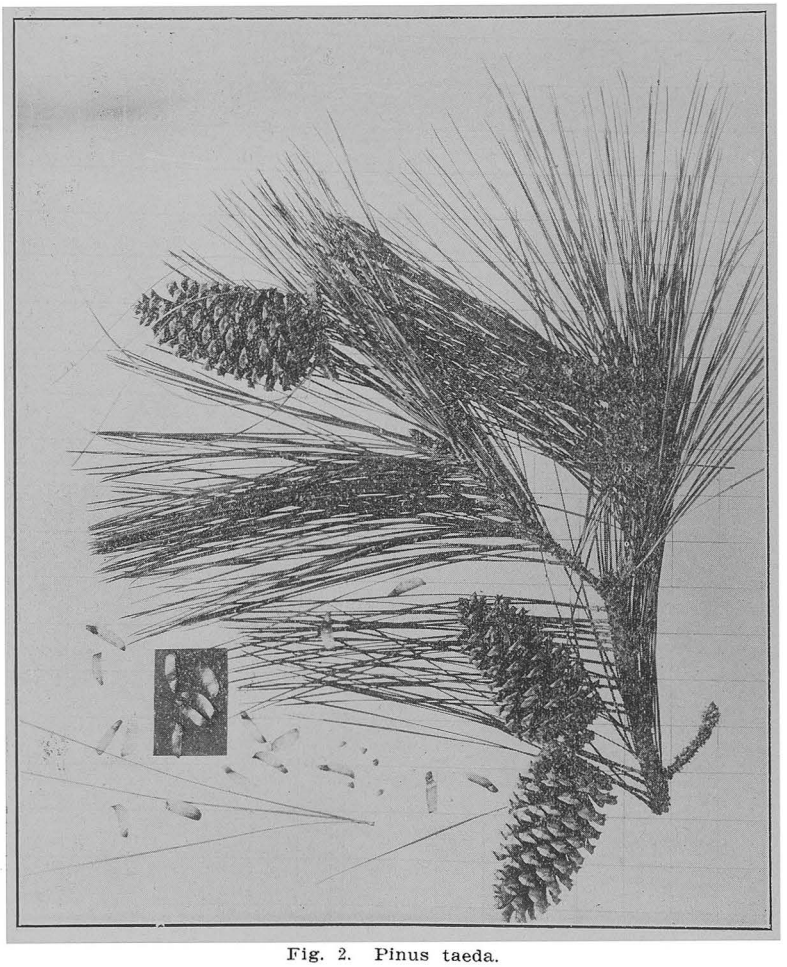


Fig. 2. Pinus taeda.

trunk, reaching a height of 80°-100° and a maximum diameter of 5°, with stout branches and reddish brown ridged bark. Leaves pale green, slender, stiff, 6′ to 9′ long, borne in clusters of three with a sheath at base. Cones conic

cylindric, 3′ to 5′ long. The scales are armed with a straight or somewhat curved stout spine.

Southern New Jersey to Florida, Louisiana, and Texas and in the Mississippi Valley to Arkansas and Oklahoma. In Texas, it extends to the valley of the Colorado.

The loblolly pine is perhaps the most aggressive of all the pines of our area. It is known in many localities as "old-field pine," because of its ability to take possession of, and reforest old fields where corn and tobacco once grew. It will in all probability be with us long after the longleaf has disappeared.

The wood is not of as good quality as the longleaf pine, being rather weak, coarse grained and brittle. It is employed in the manufacture of doors and different kinds of finish.

4. Pinus edulis Eng. Rocky Mountain Nut Pine. Pinion Nut Pine. Pinion Pine.

A small tree which may reach a height of 30°-40° and diameter of 2½°, but is usually much smaller. The trunk is frequently divided almost to the ground. Leaves dark green, stout, ¾′-1½′ long, sharp pointed and borne in clusters of two or three without a sheath. Cones nearly globose, the scales unarmed. The seed is ½′ long, nearly cylindric and contains a sweet, resinous endosperm.

Southwestern Wyoming, Colorado, Utah, western Texas to Arizona. In Texas, it is confined to the mountains of the western portion of the state.

The trees of our area are too small to be of much use for timber. The chief product of value is the nut, which is of some commercial importance.

5. Pinus ponderosa Dougl. Bull Pine. Yellow Pine. Rocky Mountain Yellow Pine.

A tree reaching a maximum height of 100°-200° and trunk diameter of 4°-6°, usually about two-thirds the above dimensions, with very thick, reddish-brown, deeply furrowed bark. Leaves in 3's, five to ten inches long. Cones reddish-brown, oval when open, narrowly ovate when closed; scales armed with a stout recurved prickle; seeds dark brown ovate, flattened at the apex 3 to 4 lines long, winged, the wing ¾ to 1 inch long, widest above the middle.

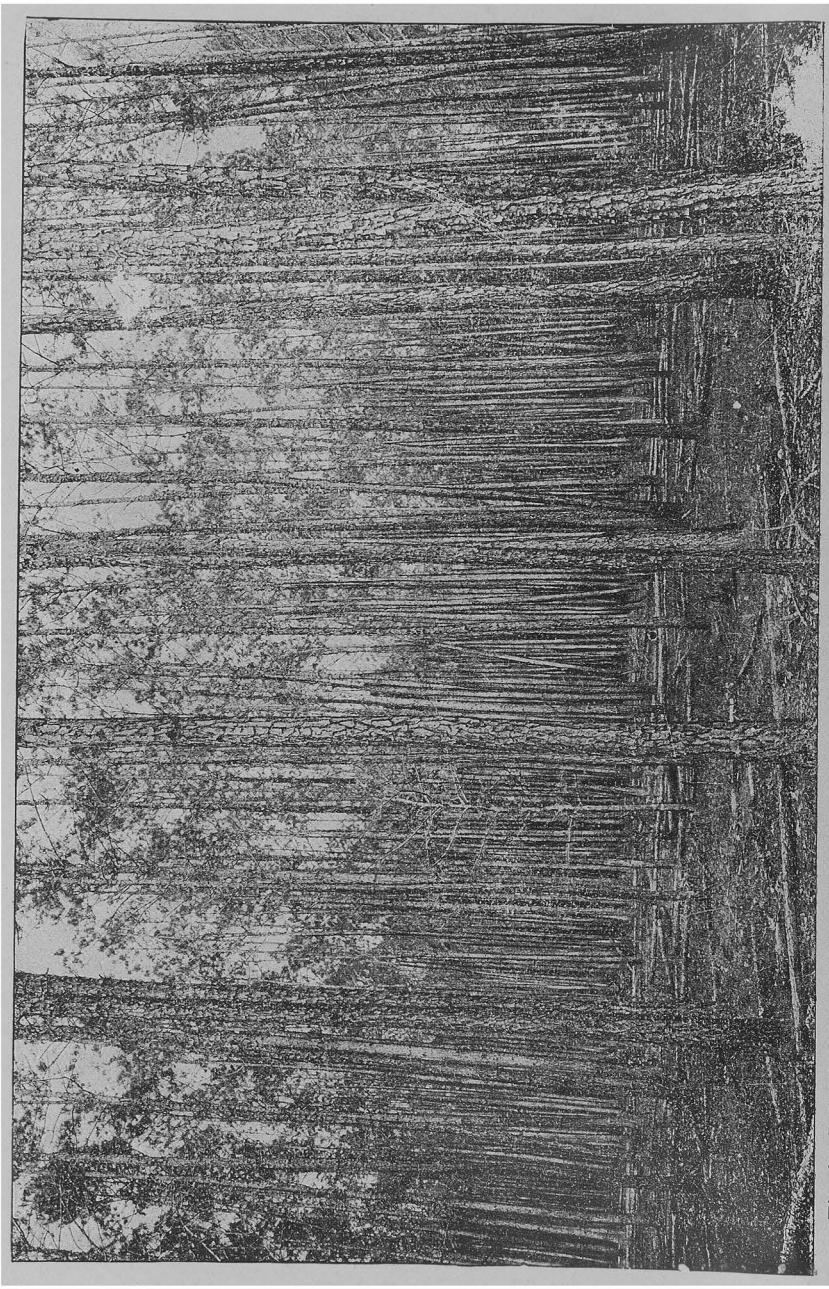


Fig. 3. Loblolly pine forest in East Texas (Bray, Distribution and Adaptation of the Vegetation of Texas).

A western mountain form extending from Montana and British Columbia to California and Mexico, eastward to Nebraska and Western Texas. In Texas, it reaches the Guadalupe and Limpia Mountains, and extends northward.

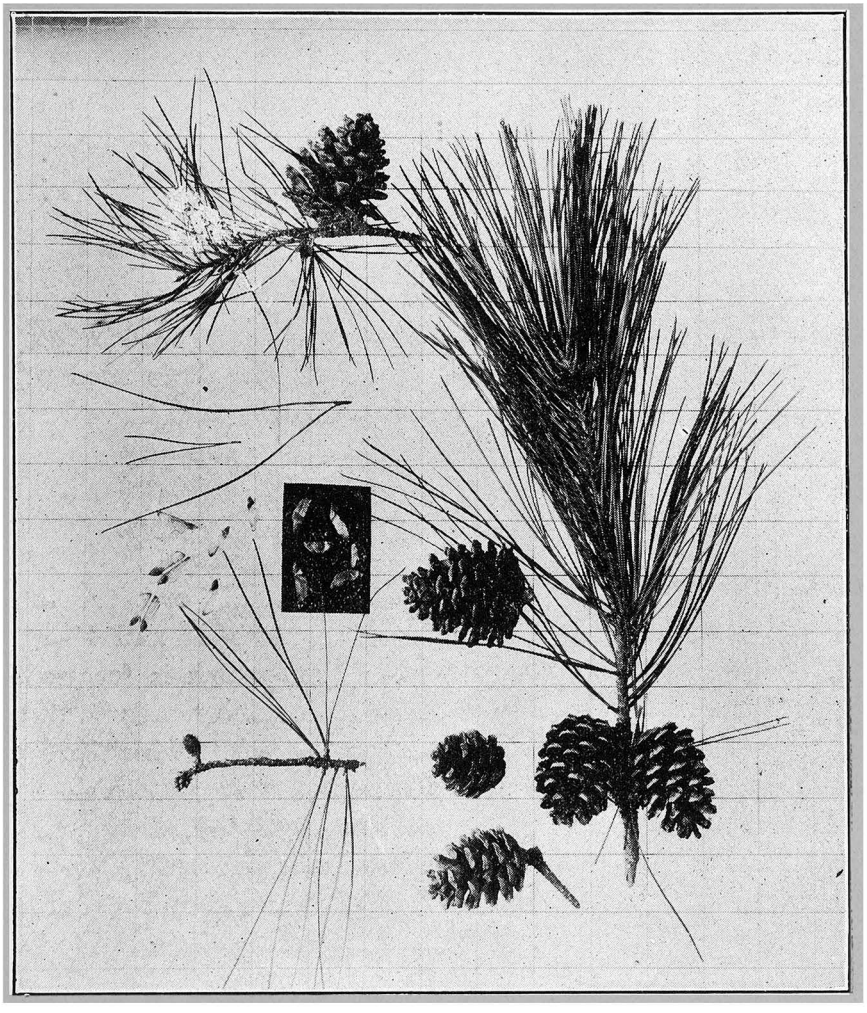


Fig. 4. Pinus echinata.

Pinus ponderosa grows in a wide variety of habitats. It is at home on the moist fertile mountain slopes and plateaus, dry or rocky ridges, fertile gravelly valleys, and arid desert slopes. It reaches its maximum size and abundance in the yellow pine belt of the Sierra Nevada.

The trees of our area are small and of comparatively little value. The wood is classed with the yellow pines. It is soft

and easily worked and does not contain so much rosin as the longleaf pine.

6. **Pinus echinata** Mil. Short-leaved Pine.

A forest tree reaching a height of 80°-100° and a maximum trunk diameter of 3° to 4° with rough, coarsely furrowed bark. Leaves deep green, borne in clusters of two or three, 3′-5′ long, shorter than any other timber pine of Texas, slender, soft and flexible. Cones 1½′-2½′ long, conic when closed and ovoid when open; the cone scales armed with slender spines, seeds ¼′ long, winged.

New York to Kansas, Florida and Texas. In Texas it is found in the northeastern portion of the state.

The short-leaf pine is the most extensively used wood in Texas. The wood is soft and works easily. It is used principally in the manufacture of doors, sash, and for interior house finishing wood.

2. TAXODIUM Rich. The Bald Cypress.

Taxodium distichum (Linnaeus) L. C. Richard. A large forest tree with maximum height of about 150° and 4°-5° in diameter, with a straight buttressed base which is frequently hollow. Trees growing in wet localities frequently develop projections from the roots known as "knees," which project above the water; bark smooth and rather brownish red, branches short, slender, horizontal or drooping, disappearing below from the old trees, forming an irregular crown. Leaves thin, flat, 2-ranked, linear, ½′-¾′ long, somewhat curved, sharp pointed, sessile; shed with the lateral twigs in the fall. Cones globose 1′ in diameter, borne in pairs at the ends of the branches.

It extends from Delaware to Florida westward along the Gulf Coast to Texas, and up the valley of the Mississippi to Missouri and southern Indiana. In swamps it is frequently the predominating tree, often forming extensive forests. In Texas it occurs sparingly in the valley of the Nueces confined mostly to overflow land along river bottoms and in canyons. The tree is a very slow growing one, and requires two or three centuries to produce a trunk large enough for saw logs.

There are few young trees coming on, and with the drainage of swamps and the building of levees along the river this tree will gradually give way to more rapidly maturing species. It has been strongly recommended by some nurserymen for

Fig. 5. Bald cypress forest about the Neches River. (Bray Bulletin 47 Bureau of Forestry, U. S. Dept. Agr.).

ornamental planting. It is successful only in wet soil, where it doubtless has some horticultural value.

The wood is light, soft-grained, but not strong. It is easily worked, and does not shrink or warp much. Its chief use is for construction purposes.

3. **PSEUDOTSUGA** Sudw.

Pseudotsuga mucronata Sudw. Douglas Spruce. Red Fir. A very large forest tree sometimes 200° high and 3°-4° in diameter, but usually smaller, 80°-100° high with narrow crown and thick, deeply furrowed bark. Leaves straight or slightly curved, ¾′-1¼′ long, dark yellowish green to bluish

green. Male cones orange red; female characterized by the elongated red bracts. The mature cones are 3'-4½' long, borne on stout stems.

British Columbia, south to Colorado, Arizona, Texas and Mexico. In Texas it is found only in the northwestern part of the state.

The heart wood is light red or yellow with almost white sapwood and is used extensively for lumber.

4. **THUYA** (Tournefort) L. Arbor Vitae.

Aromatic slightly resinous, evergreen trees or shrubs with opposite, scale-like, imbricated, four ranked leaves. Staminate and pistillate flowers borne on the same tree but upon different branchlets. Mature cones, elongated, consisting of 8-12 scales. A wide range of ornamental varieties occurs in our area.

5. **CHAMAECYPARIS** Spach. Chinese Arbor Vitae.

Resembling Thuya and distinguished from it by the globose shaped cones. Extensively cultivated for ornament.

6. **JUNIPERUS.**

Juniperus communis L. Juniper. A small erect conic shap tree with slender branches and thin reddish bark which splits into persistent scales. The leaves are awl-shaped ¼'-½' long, spreading, borne in whorls of three and persisting for many years. Fruit a subglobose berry-like cone ⅓' in diameter, blue or almost black with a bloom, borne in the axils of leaves. Seeds usually solitary.

It ranges from Greenland and Labrador to Alaska, south to Pennsylvania, Nebraska, New Mexico and Texas. It occurs only rarely in the dry sterile hills of northwestern Texas.

The wood is hard, close grained, dark brown in color. It is durable and takes a fine polish. It is used for finishing, chests and furniture. The tree is planted extensively in its natural range for ornamental purposes.

7. **SABINA.** Haller. The Cedars.

Monoecious or dioecious, strong scented trees or shrubs. Leaves scale-like or sometimes awl-shaped, appressed to the stem, not spreading on mature branches, each with a gland on the back. Flowers and fruit terminal. Cone berry-like.

Fruit reddish brown, lrage with 1-12 seeds.
- Seeds usually 4 ..... 1 S. pachyphlaea.
- Seeds 4-12 ..... 2 S. flaccida.
- Seeds 1-2 ..... 3 S. Pinchoti.

Fruit blue or blue-black, small.
- Leaves denticulate.
  - Fruit globose or oblong, seeds usually 1, rarely 2, branchlets slender..... 5 S. monosperma.
  - Fruit globose, seeds 1-4, leaves keeled and glandular ..... 6 S. sabinoides.
- Leaves entire.
  - Fruit subglobose ¼' to 1/3' long, seeds 1-4, branchlets stout, not pendulous or only slightly so, often erect..... 7 S. Virginiana.
  - Fruit subglobose ⅛' in diameter, seeds usually 2, branches pendulous..... 8 S. barbadensis.
  - Fruit subglobose ripening the second season, 1/9'-1/3' in diameter; seeds usually 2, branchlets rigid, often erect..... 9 S. scopulorum.

1. Sabinia pachyphlaea Torr. Juniper. Thick-barked Juniper. Mountain Cedar.

A tree reaching a maximum height of 50 to 60 feet and diameter of 3-5 feet, with long branches and thick, scaly, red-brown bark divided into 4 sided plates. Leaves in pairs about ⅛ inch long, appressed, keeled and glandular, bluish green. Fruit globose about ½ inch long, reddish brown, and contains a sweet mealy flesh.

At altitudes of 4000 to 6000 feet from Colorado to Nevada, Utah, Arizona, New Mexico, and Texas. In Texas it is found only in the western part of the state.

The wood is sofe and brittle and is not used extensively. The fruit is used for food by the Indians.

2. Sabinia flaccida Schlecht. Drooping Juniper. A tree reaching a height of 30° or often only a shrub. The branches are wide spreading, and the long drooping branchlets give the tree a characteristic appearance. Leaves about ⅛' long,

opposite, light yellow green, and conspicuously glandular on the back, and slightly toothed on the margin. Fruit globose to oblong, ½′ to ¾′ long, dull reddish brown with a glaucous bloom. Seeds 4-12, some of them abortive.

Extending from eastern Mexico to the Chisos Mountains of southwestern Texas. It grows best at altitudes of 6000-8000°.

3. Sabinia Pinchoti Sudworth. Pinchot's Juniper. A small tree 20 feet in height, with very short trunk. Leaves usually in threes, but sometimes in twos; margin entire, sharp pointed, keeled, and glandular, about 1/12 inch long. Fruit globose about ⅓′ long, red or copper colored without bloom; seeds 1 or 2.

Found only in Briscoe, Randall, and Armstrong counties, Texas. It grows associated with S. monosperma. It has the peculiar habit of throwing up numerous sprouts from fire killed stumps. Frequently several of these shoots develop into main trunks.

The wood is close grained, but rather soft. It is used for fence posts, and for fuel.

4. Sabinia monosperma (Engelman) Sargent. One-seeded Juniper. A tree reaching a maximum height of 40 to 50° and trunk diameter of 2° with stout branches, ascending and slender twigs. Leaves in twos or threes, about ⅛′ long, sharp pointed, and sparingly glandular; fruit dark blue glaucous with sweet resinous flesh; seeds usually solitary but sometimes 2 or 3.

Eastern slopes of the Rockies extending from Colorado to Utah, Nevada, New Mexico, Arizona, and Texas.

The wood is hard, close grained, and is very durable. It is used largely for fence posts, and for fuel. The fruit is used as food by the Indians. The fibrous inner bark is also utilized somewhat as fiber.

5. Sabinia sabinoides (H. B. K.) Small. Mountain Cedar. A shrub or small tree reaching a height of 40° and diameter of 1° with short trunk and shreddy brown bark. Leaves scale-like, appressed and imbricated, opposite, minutely toothed on the margin, ¼′-½′ long, long pointed, sparingly

glandular. Fruit almost globular ¼′-½′ in diameter, dark blue with thin, sweet resinous flesh. Seed 1-4 ribbed.

In the limestone hills of central and western Texas extending to Mexico.

The wood is hard, close grained but weak. It is used very

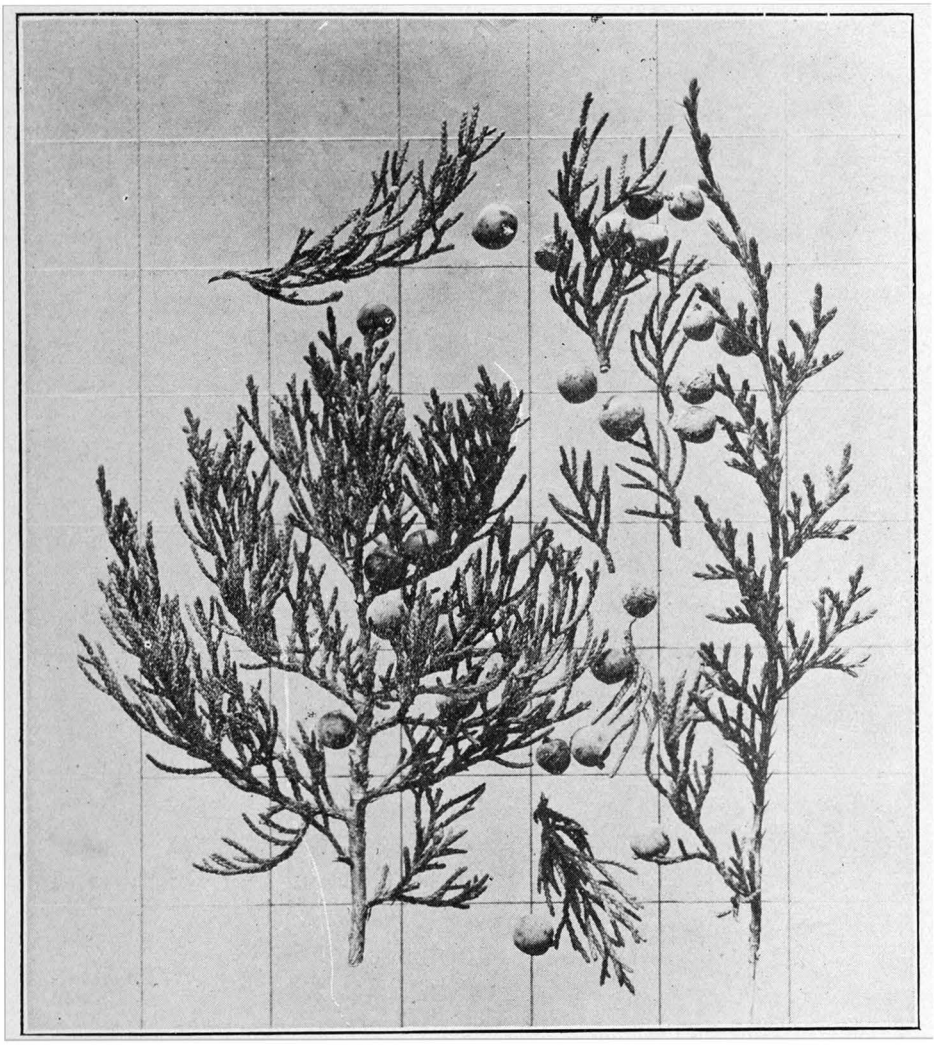


Fig. 6. Sabinia sabinoides.

extensively for fence posts, telegraph poles and for fuel. The tree is also used somewhat for ornamental planting in the region in which it is native.

6. Sabinia virginiana (L.) Antoine. Red Cedar. A rather

large tree reaching a height of 90-100° and trunk diameter of 4-5°, but usually much smaller, sometimes shrub-like, with ragged and sheddy bark. Leaves mostly scale-like, appressed, opposite and four-ranked, ¼′ long, glandular. The leaves on young twigs are frequently linear-lanceolate, ½ inch long, sharp pointed, somewhat spreading.

Fruit globular or nearly so, 1/5′-1/3′ in diameter, blue, covered with a bloom, ripening the first autumn. The seeds are flattened ¼′ long, smooth.

Nova Scotia, New Brunswick, western Ontario, South Dakota and extending southward to Florida, Alabama, and eastern Texas.

The wood is close grained, soft and weak. It has a beautiful red heart wood, which is used for furniture making, chests and pencils. It is also used extensively for posts, as it is quite durable. Oil of juniper is distilled from the leaves and wood. The tree is extensively cultivated for ornamental purposes.

7. Sabinia scopulorum Sargent. Rocky Mountain Red Cedar. A tree 30°-40° in height with a trunk sometimes reaching a diameter of 3° but more often divided near the ground into a number of secondary stems. Leaves opposite, borne in pairs, closely appressed to the stem, glandular, dark green or frequently pale and glaucous, entire on the margin. The fruit is nearly globose ¼′ to ⅓′ in diameter, bright blue with a bloom, ripening the second season. Seeds one or mostly 2, prominently grooved and angled.

From Rocky Mountain foothills, extending to western Texas, and west to Arizona, Nevada, Oregon, and Washington.

ARECACEAE Reichenb. The Palm Family.

Trees with upright stems, which bear a crown of leaves at the end. The leaves in our species are large, fan-shaped, palmately cleft or divided. Fruit a dupe or a berry.

1. Sabal Adams. The Palmetto. Unarmed trees with stout upright trunks, which are covered with a red-brown rind. The tree is characterized by the fiber-like threads which droop from the margins of the leaf segments.

Bracts of the flower cluster 7° to 8° in length.
Fruit globose, one-celled..... 1 S. Palmetto.
Bracts of the flower cluster 2° to 2-½° in length,
fruit ofen 2-3 lobed with 2 or 3 seeds..... 2 S. Mexicana.

1. Sabal Palmetto R. & S. Cabbage Tree. Cabbage Palmetto. A tree with maximum height of 30° to 40° and diameter of 2°; leaves 5° to 6° long and 7° to 8° broad, dark green, divided into numerous narrow segments. The leaf petiole is 6°-7° in length. Flowers in axils of deciduous bracts, full globose.

Found in dry or wet situations from eastern North Carolina to Florida and sometimes cultivated throughout the South Atlantic States for ornament.

2. Sabal Mexicana Mart. Palmetto. A tree reaching a height of 30°-50° feet with diameter of 2½°. Leaves 5°-6° in length and 7° in diameter, lustrous yellowish green. Fruit 2-3 lobed, ripening in the summer. Flowers in the axils of persistent bracts.

Rich bottom lands near the mouth of the Rio Grande and southward. Frequently planted as an ornamental tree in the cities along the Rio Grande.

JUGLANDACEAE Lindley. Walnut Family. Large aromatic trees with alternate, odd pinnate leaves. The flowers are monoecious, the staminate borne in catkins, the pistillate solitary or in clusters at the ends of branches. Fruit a nut borne inside a dry husk which is dehiscent or indehiscent.

Husk indehiscent, nut with numerous rough projections or furrows..... 1. Juglans.
Husk dehiscent into four segments, nut more or less angled but smooth..... 2. Hicoria.

1. Juglans L. The Walnuts. Large aromatic trees with alternate odd pinnate leaves, furrowed bark, and a rough, sculptured nut which is produced inside a fibrous, indehiscent husk.

Leaflets 15-23; nut irregularly ridged and prominently sculptured..... 1. J. Nigra.
Leaflets 9-23; nut deeply grooved..... 2. J. rupestris.
Leaflets 11-17; nut inconspicuously grooved..... 3. J. Californica.

1. Juglans nigra Linnaeus. Walnut. Black Walnut. One of the grandest and most valuable of our forest trees, reaching a height of 100° to 150° and trunk diameter of 4°-6° with straight trunk, stout branches, and thick, furrowed bark. Leaves 12′-28′ long; leaflets 12-23, ovate-lanceolate, glabrous above, pubescent below. Nut nearly round, somewhat flattened, 1⅛′ to 1½′ in diameter. The kernel is sweet and edible.

In well drained soil from Ontario south to the Gulf States and west to Nebraska and Texas. Because of the value of the nuts and of the wood, the black walnut has been a favorite tree and is frequently planted throughout its range.

The wood is heavy, hard, strong and rather coarse. The heart wood is a beautiful dark brown, and takes a high polish. It is much sought by furniture makers and is used extensively in the manufacture of ornaments and for gun stocks. The supply of available timber has been almost exhausted. The tree has been planted extensively for ornament, but does not make a very satisfactory shade tree.

2. Juglans rupestris Engelm. Texan Walnut. A forest tree 50° in height but in our area usually much smaller. The upright growing branches form a narrow stiff crown. The bark on young trees is thin and pale, becoming deeply furrowed and broken on the older portions. Leaves 7′-15′ long, with 9-23 short stalked, ovate-lanceolate leaflets which are 2½′-5′ in length by ⅓′-1½′ in width. The leaflets are dark yellow green, glabrous or pubescent along the midribs, finely serrate, somewhat curved with a rounded base. Fruit globose to oblong ½′ to 1½′ in diameter with a thin husk; nut globose and with deep prominent ridges, sweet and edible.

Extends from the limestone regions of western Texas to Arizona, New Mexico, and northern Mexico. In Texas it occurs along stream banks of the limestone area, reaching its maximum size in the canyons.

The trees of our area are small and of little economic importance. The wood is hard, close-grained, weak, dark brown in color. The tree is occasionally planted for ornament, and grows well in localities outside its natural range.

3. Juglans Californica Wats. California Walnut. A stately forest tree reaching 60° in height by 18′-20′ in diam-

eter, frequently much smaller, with stout branches, somewhat drooping and forming a beautiful, rounded, symmetrical crown. Leaves 6′-9′ long. The leaflets are long pointed, sharply serrate, rounded or heart-shaped at base, sessile, glabrous or bearing tufts of hair in the axils of primary veins. Fruit globose ¾′-1¼′ in diameter with thin husk. The nut is globose without prominent ridges; the seed is sweet and edible.

Extends from the valley of the Colorado through western Texas to California.

The wood is dark brown or mottled, hard, coarse grained; used in the manufacture of furniture. The tree is useful for ornamental planting. It has been greatly improved by hybridization with the European walnut to produce a beautiful thrifty, quick growing tree,—the Burbank walnut.

2. **HICORIA** Rabinesque. The Hickories.

Large, fine forest trees with very hard, tough, elastic wood, and hard, fissured, tight, or scaly bark. The young branches are flexible and not easily broken. The leaves are alternate, deciduous, odd-pinnate with serrate margins. Fruit a hard bony nut surrounded by a woody husk which separates at maturity into four segments. Staminate flowers clustered, usually on the wood of the preceding year; the pistillate in spike-like clusters at the ends of the wood of the present season.

1. Bud scales few, valvate (in pairs), fruit with more or less prominent ridges at the sutures of the husk, shell thin except in (3).
   - (1) Leaflets 9-17, usually about 13; nut ovate-oblong, circular in cross section, kernel sweet and edible..... 1 H. pecan.
   - (2) Leaflets 7-11, nut oblong, elliptic in cross section; kernel bitter..... 2 H. Texana.
   - (3) Leaflets 5-9; shell of nut very thick
     - (5) Leaflets 7-11; nut flattened, sometimes broader than long..... 3 H. myresticaeformis. 4 H. aquatica.
     - (4) Leaflets 9-13; nut corrugated..... 5 H. cordiformis.

2. Bud scales numerous, imbricated, fruit not winged as above. The shell of the nut is always thick and bony.
   (1) Bark separating from trunk in shaggy plates, leaflets 5-7..... 6 H. ovata.
   (2) Bark not separating as above;
      a. Leaflets 7-9..... 7 H. alba.
      b. Leaflets 5-7..... 8 H. glabra.

1. Hicoria pecan (Marsh) Britton. Pecan. A tall tree 100° to 170° in height and 6° in diameter with an enlarged, buttressed base. Trees growing in the open have a rounded crown which is widespreading. Leaves 12′ to 20′ in length with 9-17 leaflets which are lanceolate, long pointed, curved, serrate 2¾′-6′ long, rounded, or wedge-shaped at the unequal base, hairy when young, becoming smooth with age. Fruit in clusters of 3-11, oblong 1⅜′-2⅜′ long, the husk splitting to below the middle. The nut is ovoid to ovoid-oblong, reddish brown, nearly cylindrical.

In the Mississippi valley from Indiana to Iowa, south to Alabama and Texas. In Texas it occurs along streams central and southwestern.

The wood is heavy, hard, but not strong and is less valuable than the other hickories. The nuts are the most valuable of the hickories, and are an important article of commerce. Many improved varieties are now known and are being extensively planted. The native trees are frequently budded with the more desirable varieties. Pecans are also desirable shade trees in certain cities of the state, but they are rather slow growers for this purpose, and do well only in soils that are adapted to them. They are also difficult to transplant.

2. Hicoria Texana (Leconte) Britton. Bitter Pecan. Texan Pecan. A forest tree 100° high and 3° in diameter, but generally much smaller,—15° to 25° tall and 8′-10′ in diameter, with a narrow, rounded crown. Leaves 10′-12′ long with 7-11, occasionally 13, lanceolate, pointed, serrate, leaflets, which are curved, almost sessile, hairy at first, becoming smooth, 3′-5′ long, 1½ wide. Fruit clustered 1½′ to 2′ long, with a thin husk. The nut is oblong-ovoid, pointed at both

ends, somewhat flattened, wrinkled with a thin shell. The seed is extremely bitter.

Occurs only in Texas, reaching its maximum size along the Brazos and extending throughout the low, wet woods of eastern Texas, 100 to 150 miles inland from the coast.

The wood is tough, close-grained, and strong. It is used for fuel.

3. Hicoria myristicaeformis (Micheaux) Britton. Nutmeg Hickory. Bitter Walnut. Tall straight trees 100° high and 2° in diameter with a narrow rounded open crown. Twigs slender, bark ½′ to ¾′ thick, close shallowly fissured. Leaves 7′-14′ long with pubescent petioles, leaflets 5-11, ovate to ovate lanceolate, almost sessile, sharp-pointed, coarsely serrate, dull green above, pale, lustrous, and somewhat hairy beneath, 4′-5′ long, 1½′ wide. Fruit cylindrical or slightly obovate, prominently 4-ridged with a thin husk. The nut is pointed at both ends, without grooves, 1′ long by ¾′ broad, resembling a nutmeg. The shell is very thick and bony.

Borders of swamps and streams from South Carolina to Alabama, Mississippi, Arkansas, and Texas. In Texas it extends as far west as Mexico.

The wood is tough and strong, close grained, with a relatively large proportion of sap wood. It is used for fuel, and in the manufacture of machinery. The tree is desirable for ornamental planting.

4. Hicoria aquatica Britton. Water Hickory. Bitter Pecan. A tree 80′-100′ high with trunk diameter of 2′, usually much smaller. The slender upright branches form a narrow crown. Leaves 9′-15′ long with 7-13 ovate lanceolate, almost sessile, long pointed leaflets, 3′-5′ long, ½′-1½′ wide. Bark brown, separating in thin appressed scales, rather roughish in appearance, somewhat reddish. Fruit clustered, oblong 1½′ long, with prominent ridges. Nut 1′ long ¾′ broad, pointed at the ends, flattened, 4-angled with a thin shell. Kernel very bitter.

In river swamps and wet situations from Virginia to Illinois, and south to Florida and Texas, extending to the valley of the Brazos.

The wood is strong, but rather brittle and soft. It is used principally for fuel.

5. Hicoria cordiformis (Wagenheim) Britton. Pignut. Pig Hickory. Tight Bark Hickory. A forest tree 100° high and 2°-3° diameter, with stout branches, widespreading crown, and tight, thin, light gray bark which sometimes separates to form thin plates. Twigs when young, thin and hairy, becoming brown and smooth with age. Leaves 6′-10′ long, the main axis somewhat hairy, with 5-9 leaflets. The leaflets are lanceolate to oblong or obovate, 2′-6′ long, smooth above, hairy beneath, somewhat curved, unequal at base. Fruit globose ¾′-1½′ long, 4-winged from the apex to the middle, husk thin, about 1-16 inch, covered with yellow scurfy pubescence, tardily dehiscent. Nut ovoid or oblong, somewhat flattened, sometimes broader than long, with thin and brittle shell. Kernel very bitter.

Quebec west to Minnesota, south to Florida, and west to Texas. In moist soils to the Trinity valley.

The wood is tough, heavy, strong, and durable. Used for vehicles and machinery.

6. Hicoria ovata (Miller) Britton. Shellbark Hickory. Scaly Bark Hickory. Red Hickory. A large forest tree 100° or more in height and 3°-4° diameter. Bark or trunk separating in thin, long, flat plates, light gray or darker. Leaves 8′-14′ long with 5-7, generally 5, leaflets. The leaflets are ovate to ovate-lanceolate, 4′-7′ long, the lateral sessile, the terminal stalked. Fruit subglobose, or obovate, depressed at the apex, 1′-1½′ long. The husk is thick and the segments split freely to the base. Nut variable in shape and size, oblong, subglobose, or obovoid, somewhat flattened and wrinkled. Shell rather thin. Kernel sweet and edible, used extensively for food.

Quebec to Minnesota and Kansas, and extending south to Florida and Texas. In Texas it occurs in rich moist soils of the eastern portion.

The wood is hard, strong, and elastic. It is used in the manufacture of vehicles, and machinery. The nut is an important article of commerce.

7. Hicoria alba (Linnaeus) Britton. White Hickory.

Mocker Nut. A large handsome forest tree with maximum height of 100° and trunk diameter of 3°, but usually much smaller, with light gray, fissured bark which is never scaly. Leaves with a resinous odor, 8′-12′ long, with 5-9, generally 7 leaflets; leaflets oblong lanceolate, or obovate-lanceolate, sessile or the terminal one short-stalked, pointed at the apex, hairy at first, but becoming smoother with age. Fruit subglobose, elliptic, 1½′-2′ long, with a thick husk which splits to the base. Nut globose to elliptic, smooth, without prominent angles; shell thick, kernel sweet and edible.

Ontario south to Florida and west to Texas, extending to the valley of the Brazos.

Wood and uses similar to Hicoria ovata.

8. Hicoria glabra (Mill.) Britton. Pignut. Black Hickory. A tall forest tree 80°-90° high and 3°-4° in diameter with narrow crown, somewhat pendulous branches, and bark of trunk usually dark gray to almost black, tight, fissured, with narrow furrows. Twigs slender, hairy at first, becoming smooth and reddish brown with age. Leaves 6′-9′ long with smooth axis. Leaflets 3-9, more commonly 5-7, 2½′-6′ long, pointed, hairy when young, smooth or with a few hairs in the axils of the veins when mature, unequal at base. Fruit obovoid or globose somewhat pear-shaped, 1¼′ long; husk thin; nut obovoid to elliptic, smooth, shell thick, kernel sweet or bitter.

Maine to Nebraska, south to Florida and west to Texas. Extends to the valley of the Nueces.

Uses similar to H. ovata.

LEITNERACEAE Drude. Cork Wood Family.

Leitnera Floridana Chapm. A shrub or small slender tree sometimes 20° high and 4′-5′ in diameter, with dark gray fissured bark about 1-16′ thick. Leaves alternate, somewhat leathery, deciduous, 4′-6′ long, 1½′-2½′ wide with petiole 1′-2′ in length, margin entire or somewhat wavy, but not serrate, pointed at the apex, equal and gradually narrowed at base, bright green and smooth above, hairy beneath. Flowers in aments, the male and female on different plants. Stamen

bearing aments clustered at the ends of branches, pistils bearing aments scattered on the stem. Fruit a compressed dry brown drupe, solitary **or** in clusters of 2-4, ripening before the leaves are mature, ¾′ long, ¼′ wide.

Swamps of Florida, Texas and southeastern Missouri. In Texas it occurs in swamps of the Brazos River.

The wood is lighter than any other in our area. It is frequently used for floats of fishing nets.

MYRICACEAE Dumort. Bayberry Family.

Morella cerifera Linnaeus. Wax Myrtle. Bayberry. A fragrant shrub or small tree occasionally reaching a height of 40° and trunk diameter of 8′-10′, but usually much smaller, shrubby and forming dense thickets. Bark smooth, light gray, about ¼′ thick. Leaves alternate, simple, thick, firm, evergreen, fragrant, oblanceolate or oblong-spatulate, sparingly notched or entire, 1½′-4′ long, glandular on both surfaces, hairy beneath. Flowers in aments appearing about the end of March, staminate and pistillate borne on different plants. Fruit short spikes of dry, ovoid drupes covered with waxy coating.

New Jersey, Delaware, Maryland, Florida, Arkansas, Mississippi and Texas.

The wood is soft, brittle, and used only for fuel. The wax which occurs on the fruit is sometimes collected and used for candles.

SALICACEAE Lindley. The Willow Family.

Trees or shrubs with alternate, simple leaves with or without stipules. Flowers borne in catkins appearing before or with the leaves, staminate, and pistillate on different trees. The fruit is a dehiscent capsule containing numerous seeds, each with a dense tuft of long, silky, white hairs at the apex.

Leaves less than twice as long as broad, winter buds with numerous scales..... 1. Populus.
Leaves more than twice as long as broad, winter buds with one outer scale..... 2. Salix.

1. **POPULUS** L. The Poplars.

Large, rapidly growing forest trees with large, scaly, resinous buds; pale, furrowed bark; alternate, toothed or lobed leaves, and flowers borne in catkins.

Petiole of leaf round, scarcely or not at all flattened laterally, buds cottony, leaves more or less lobed ..... 1. P. alba.
Petiole of leaf flattened laterally, leaves with margins notched or toothed, but not lobed.
Leaves broadly deltoid, abruptly sharp pointed at the apex.
Leaf blades for the most of the leaves longer than broad..... 2. P. deltoides.
Leaf blades mostly broader than long.
Leaves truncate and slightly cordate at base with many small teeth..... 3. P. Fremontii.
Leaves more or less cuneately narrowed on the petiole with few teeth which are relatively larger than the preceding... 4. P. Wislizeni.

1. Populus alba L. White Poplar. Silver-leaf Poplar. A large tree with height of 100° and trunk diameter of 3° or frequently much smaller, with numerous suckers developing from the roots. Bark on young trees smooth, gray, or a greenish white; on old trees furrowed, gray or brown. Leaves ovate or triangular, irregularly toothed, or 3-5 lobed, pointed, firm, densely white, velvety, hairy beneath when young becoming smoother with age. The leaf petiole is almost round, sometimes flattened somewhat laterally, shorter than the blade of the leaf.

Introduced from Europe. It is cultivated throughout a large portion of the state for ornament.

The silver poplar grows rapidly, is adapted to a wide range of soils, is easily propagated and stands pruning well. It is planted in many localities as an ornamental tree, for which purpose it is perhaps the most valuable of the poplars.

2. Populus deltoides Marshall. Cottonwood. Carolina Poplar. Necklace Poplar. A large tree 120° or more in height and 6°-8° in diameter, found principally along stream banks. Bark gray with a greenish cast, thin and smooth on young twigs, and branches, thick and fissured on old branches and

trunk. Leaf with flattened petiole, blade about 1½′-5′ long and almost as wide, coarsely toothed, teeth incurved, glandular, veins prominent on both surfaces. Flowers borne in catkins appearing before the leaves. The staminate catkins 1½′ long, the pistillate 1½′-2′ long before the fruit ripens, becoming 3′-4′ long as the fruit develops.

Quebec to Florida and west to the Rocky Mountains. It grows in moist soils along lakes and streams.

The wood is principally sap wood which is light, soft, and weak. It warps badly, and is dried only with difficulty; used principally for box boards, siding, sheeting, excelsior, and pulp. The supply has been almost exhausted. The cottonwood is sometimes planted as an ornamental tree, but this is to be recommended only where a quick growing shade, or windbreak must be had at the sacrifice of more desirable slower growing varieties.

3. Populus Fremontii Watson. Cottonwood. A tree 100° in height and 5°-6° in diameter with a rather broad, open crown and short trunk. Bark on young branches, light gray brown, thin and smooth; on older parts, thick, dark brown with reddish tinge, and deeply fissured. Leaves deltoid or reinform, 2′-2½′ long, 2½′-3′ broad. Coarsely serrate, with 4-12 incurved glandular tipped teeth on each side.

A western form extending from California eastward to Nevada, and south to Texas. It occurs along water courses throughout the western part of the state.

Its uses are similar to Populus deltoides.

4. Populus Wislizeni Sarg. Cottonwood. Occurs in the valley of the Rio Grande from El Paso to the Gulf. It is distinguished from P. Fremontii by the greater length of the flower pedicel, and the more sharply pointed leaves.

2. **SALIX** L. Willow.

Trees or shrubs with soft wood, simple, alternate leaves which are elongated, pointed, deciduous, without lobes, usually serrate. Flowers in catkins appearing before or with the leaves. Staminate and pistillate flowers borne upon different trees. Fruit a dehiscent capsule containing many seeds which

bear a tuft of long silky hairs at the apex. Found principally in damp situations. There are so many hybrids and introduced species that the classification of the willows is difficult and sometimes impossible. The following key includes the forms which are known to occur in our area.

Branches decidedly drooping..... 1. S. babylonica.
Branches not decidedly drooping.
Leaves small, 1/3'-1 1/3' long, entire or nearly so, pale green on both sides..... 2. S. taxifolia.
Leaves long, 4'-7', silvery white below..... 3. S. longipes.
Leaves green on both surfaces, 3'-6' long, ⅛'-¾' wide, narrowly lanceolate, long-pointed..... 4. S. nigra.
Leaves pale, or glaucous below, 2-½'-4' long, ¾'-1¼' wide, broadly lanceolate..... 5. S. amygdaloides.
Leaves linear, lanceolate green on both surfaces, 2'-6' long, ⅛'-1/3' wide..... 6. S. interior.

1. **Salix babylonica** L. Weeping Willow. An ornamental tree which has been introduced from Asia and is grown quite extensively throughout North and South America. Its distinguishing mark is the drooping habit of its branches from which its name is derived. Sometimes reaching a height of 60′ and a trunk diameter of 3°-5°, with bark on old parts gray, rough and fissured. The young twigs are green, slender, and drooping. Leaves linear to linear lanceolate, pointed, pale green below. It is used only as an ornamental shade tree.

2. **Salix taxifolia** H. B. K. Willow. Yew Leaved Willow. A tree sometimes reaching a height of 40°-50° and trunk diameter of 18′, with broad open crown, light gray-brown, fissured bark, ¾′-1′ thick, covered with small scales. Leaves smaller than any of the other species of willow, 1/3′-1 1/3′ long, 1/12′-1/8′ wide.

Arizona southward through western Texas and Mexico to Guatemala. It is sometimes planted for ornament.

3. **Salix longipes** Anderson. Ward's Willow. Trees reaching a height of 30° and trunk diameter of 6′-8′, with thick, brown, rough bark divided into angular plates, hairy and reddish brown on young twigs. Leaves lanceolate to ovate lanceolate, somewhat pointed at the apex, round or heart-shaped at base, bright green and smooth above, pale and glaucous or hairy beneath. Flowers in April and May.

Maryland to Kentucky, and Missouri, south to Florida, Texas, New Mexico, and Mexico.

The wood is weak, soft, and rather dark brown and of little economic value.

4. Salix nigra Marsh. Black Willow. A tree reaching a maximum height of 100°, and diameter of 3°, but commonly much smaller,—30°-40°. The crown is wide spreading. Bark of trunk rough, thick, flaky, dark brown or nearly black on old portion, shoots hairy at first green or greenish brown, becoming brown and smooth with age. Leaves narrowly lanceolate, long pointed, bright green above, paler and smooth beneath, closely serrate, sometimes with hairs along veins. Flowers in April and May.

New Brunswick west to North Dakota, south to Florida and west to Texas. Grows along stream banks.

The wood is light, soft, warps badly, and has not been of much economic importance.

5. Salix amygdaloides Anders. Peach Willow. Almond Willow. A tree reaching 60°-70° in height and 2° in diameter. Regarded by some as a variety of S. nigra. Bark of trunk fissured, ½′ to ¾′ thick, brown tinged with red. Young twigs smooth, orange to reddish brown, brittle. Leaves lanceolate to ovate lanceolate, somewhat curved, long pointed, light green above, pale and glaucous beneath, closely serrate. Flowers earlier than the preceding species.

Quebec west to Manitoba, southward to Ohio and westward to the Rocky Mountains, extending to southwestern Texas. Common along the Rio Grande from El Paso northward.

Too rare to be of much importance. The wood has been used in the preparation of charcoal.

6. Salix interior Rowlee. Sand Bar Willow. A shrub, or sometimes a tree reaching 40°-50° in height, but usually not over 20°. Sometimes forming thickets. The bark is brown, rather thin, ⅛′-¼′, and almost smooth. The young twigs are slender, smooth, or with fine hairs, reddish, becoming brown with age. Leaves linear lanceolate, often falcate, pointed at both ends, light yellowish green, darker on upper than on lower surfac, remotely notched with projecting teeth. Petiole of the leaf grooved ⅛′-¼′ long.

Along streams and sand bars from Quebec southward, Virginia, Kentucky, Nebraska, and Texas. In Texas it is found west of the Pecos River.

Economic uses similar to Salix amygdaloides.

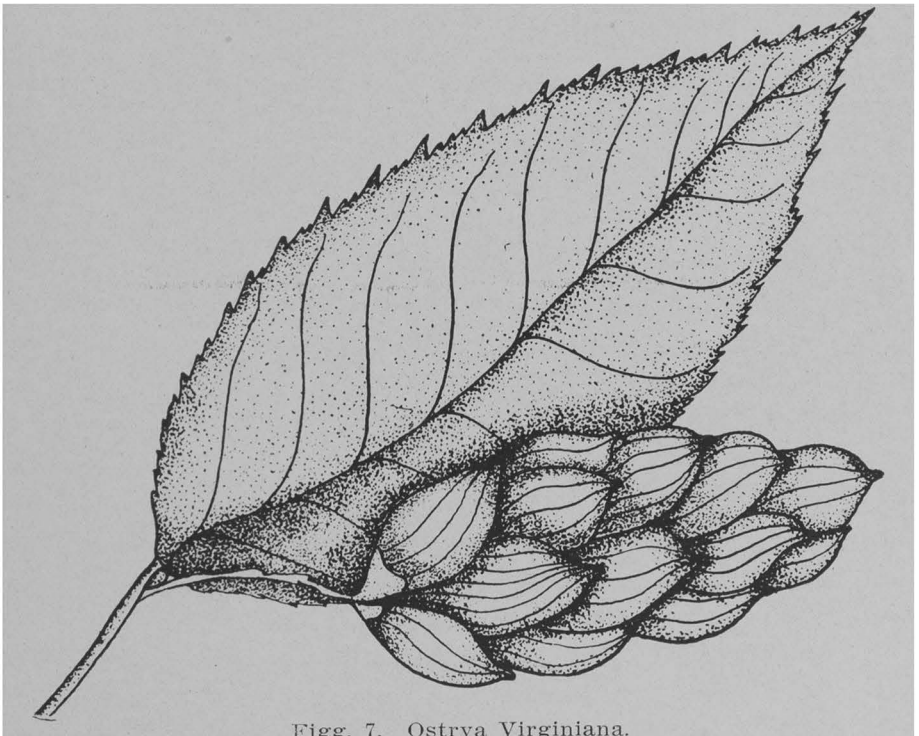
CORYLACEAE Mirbel. Hazel Nut Family.

Small trees with close grained, hard wood, and smooth or scaly bark. Leaves simple, alternate, deciduous, straight veined and doubly serrate. Flowers borne in catkins in the early spring.

Bark on main trunk smooth..... 1. Ostrya.
Bark on main trunk ridged..... 2. Carpinus.

1. **OSTRYA** Scap. Hop Hornbeam.

1. Ostrya Virginiana (Mill) Willd. Ironwood. American Hop Hornbeam. A small tree usually 20°-30° high with trunk



Figg. 7. Ostrya Virginiana.

diameter of 18′-20′. The branches are long, slender, and drooping, forming a rounded open crown. Bark brown, thin and

shreddy on trunk and older branches, green and hairy on young twigs. Leaves ovate to lanceolate, acute at the apex, rounded, wedge-shaped, or heart-shaped at base, sharply, doubly serrate, 2½′-4′ long, thin and tough. Flowers borne in catkins in early spring. Fruit hop-like, 2 to 3 times as long as wide, consisting of bladder-like bracts which enclose the nuts.

Valley of the St. Lawrence, south to Florida and west to Texas, Ontario, Minnesota, South Dakota and Kansas. It is found principally in dry soil in thick woods.

The wood is very hard, tough, close grained. It is used for fuel, fence posts, tool handles, and mallets. The small size of the tree makes it of little economic importance. It is sometimes planted for ornament.

2. **CARPINUS** L.

1. **Carpinus Caroliniana** Walt. American Hornbeam. Water Beech. Blue Beech. Small trees with fluted or ridged trunk rarely 40° high with diameter of 2°. Bark smooth, close, gray on older parts, hairy and green on young twigs. Leaves ovate to oblong, pointed, doubly serrate, somewhat unequal-sided, hairy when young, smoother with age, dull bluish green above, yellowish beneath. Flowers borne in catkins in early spring. The nut is ⅓′ long, ovoid, flattened and ribbed. The scales are leaf-like, three-lobed, the lateral lobes much shorter than the terminal.

Nova Scotia to Florida, west to Ontario, Minnesota, Kansas, and Texas. It occurs in moist woodlands, and along streams, but may also be found in dry woodlands. It grows principally in the shade of larger forest trees.

The wood is heavy, hard, tough, but the small size of the tree and the crookedness of the stem renders it of no economic importance for timber. It is sometimes planted for ornament.

BETULACEAE (Tournefort) L. Birch Family.

Monoecious, aromatic trees or shrubs with simple, alternate, straight veined, usually serrate leaves. Flowers borne in catkins, opening in the early spring usually before the leaves.

The fruit is a leafy scaled catkin or a woody cone-like aggregate of bracts. Bark smooth, shining, usually scaling away in thin plates.

Bracts of the fruit forming a woody, persistent cone ..... 1. Alnus.
Bracts of the fruit membranous deciduous with the nut..... 2. Betula.

1. **ALNUS** L. Alder.

Alnus rugosa (Du Roi) K. Koch. Smooth Alder. A shrub or small tree sometimes reaching a height of 30°. Bark thin, smooth, brown. Leaves 2′ to 4½′ long, thick, obovate, oval, blunt, or rounded at the apex, sharply serrate, dark green above. Nut ovate, sharply margined without wings.

Maine to Minnesota, Florida and Texas. Usually along streams. The trees are too small to be of value for timber. The wood is used for fuel and for charcoal.

2. **BETULA** L. Birch.

Betula nigra L. Birch. Water Birch. Red Birch. A large forest tree reaching a height of 80°-90° and trunk diameter of 5°. The branches are slender and the crown is narrow. Bark on branches thin, smooth, reddish brown, or silver gray, peeling off in thin layers; on main trunk thick, reddish brown, scaly. Leaves rhombic-ovate, irregularly doubly toothed or sometimes lobed, 1½′-3′ long, dark green and lustrous above somewhat hairy beneath, or smooth except along the veins. Flowers opening before or with the leaves.

Massachusetts to Minnesota and Kansas, Florida and Texas. Chiefly along banks of streams, ponds, and swamps. In Texas it extends to the Trinity Valley.

The wood is hard, strong, light brown. It is used for furniture, and for fuel.

FAGACEAE Drude. The Beech Family.

Monoecious trees with watry juice; leaves alternate, pinnately veined, mostly deciduous; staminate flowers in elon-

gated catkins, or rounded heads, pistillate flowers, solitary or clustered. Fruit a one-seeded nut, borne in a prickly bur or seated in a woody, scaly cup. This is the most important economic group of trees occurring in the state.

Staminate flowers borne in rounded heads; nut triangular, borne inside a woody husk armed with recurved prickles..... 1. Fagus.
Staminate flowers in elongated slender catkins.
Nut borne inside a closed woody husk, but armed with straight prickles..... 2. Castanea.
Nut seated in a scaly, woody cup..... 3. Quercus.

1. **FAGUS** (Tournefort) L. Beech.

Fagus Americana Sweet. The Beech. A tree usually about 70° to 80° in height, but sometimes larger. The lower branches are drooping, the middle almost horizontal, while the upper are ascending, forming a rather narrow crown. Bark light gray, thin, and smooth. Winter buds about one inch long, taper pointed, with light brown scales. Leaves ovate to oblong-ovate, usually rather long taper-pointed with a wedge-shaped or sometimes heart-shaped base. The margin of the leaf is regularly minutely serrate, the veins ending in the apex of the teeth, smooth above, minutely hairy or smooth below. Nuts ⅜′-½′ long, triangular, reddish brown, quite hairy.

Nova Scotia to Ontario and Wisconsin, extending south to the Gulf States and west to Texas. In Texas it extends to the Trinity River.

The wood is hard, strong, tough, close grained, takes a high polish. It is used for building material, fuel, staves, and heading. The nut is sweet and edible. The tree is not well adapted for ornamental purposes, because the roots grow near the surface, and grass does not thrive under it.

2. **CASTANEA** (Tournefort) Adanson. The Chestnut.

Castanea pumila Miller. Chinquapin. A shrub or medium sized round topped tree 50′ high with spreading slender branches, furrowed scaly bark. Leaves obovate, thick, firm, rounded or pointed at the apex, wedge shaped or sometimes unequal at the base, sharply toothed, 3′-4′ long, 1½′-2′ wide,

yellowish green, lustrous above, paler and somewhat hairy beneath. Flowers in long catkins. Fruit a closed woody bur with straight prickles ripening in the autumn and opening with the first frosts. Nut compressed sharp pointed ¾′-1′ with sweet edible seed.

Pennsylvania, Florida, Missouri and Texas.

The wood hard, strong, close grained, light with little sap wood. It is used for railroad ties and fence posts.

3. **QUERCUS** (Tournefort) L. The Oaks.

Large forest trees or shrubs with simple, alternate deciduous or evergreen leaves which are entire toothed or lobed. The leaves are rather thick and woody and remain on the tree either throughout the winter or until nearly all other deciduous leaves have fallen. The staminate flowers are borne in long, slender, pendulous catkins, the pistillate solitary or in clusters. The fruit is a nut borne in a shallow woody cup. In the so-called white oaks, the fruit ripens the first year, while in the black oaks, it does not mature until the second. The oaks comprise more species than any other genus of trees within our area, and are frequently difficult to identify with certainty, as a number of the species readily hybridize. The oak is one of our most valuable sources of timber, furnishing a large part of the hard woods. It is also cultivated extensively for shade and ornament.

I. Mature leaves, entire, notched or lobed, rarely bristle tipped; fruit maturing the first season ..... White Oaks.

A. Leaves deciduous.

1. Leaves lobed, the lobes rounded, never tipped with bristles.

a. Leaves smooth beneath, 3-9 lobed.. 1 Q. alba.

b. Leaves hairy beneath.

(1) Leaves oblong-obovate, usually 5-lobed with stellate hairs above.. 2 Q. stellata.

(2) Leaves deeply lobed, cup fringed by the awned scales..... 3 Q. macrocarpa.

(3) Leaves deeply 5-9 lobed, nut often nearly enclosed in the cup 4 Q. lyrata.

2. Leaves straight veined, variously toothed or notched, but not deeply

lobed (Chestnut Oaks).

a. Acorns sessile.

(1) Leaves obovate, small tree or shrub ..... 5 Q. prinoides.

(2) Leaves oblong to lanceolate, sometimes obovate..... 6 Q. Muhlenbergii.

b. Acorns borne upon stalks about as long as the leaf petiole.

(1) Leaves densely hairy below.... 7 Q. Michauxii.

(2) Leaves smooth below..... 8 Q. Brayi.

3. Leaves entire, undulate, or lobed only near apex.

a. Cup saucer-shaped, thin, leaves hairy beneath ..... 9 Q. Durandii.

b. Cup saucer-shaped, leaves smooth, cup thick..... 10 Q. Laceyi.

B. Leaves persistent until the appearance of the new leaves of the following year, mostly evergreen.

1. Leaves entire on mature branches, sometimes serrate on young twigs, dark green, southeastern species..... 11 Q. Virgiana.

2. Leaves spinulate toothed to entire, dark green, western species..... 12 Q. Emoryi.

3. Leaves sinuate lobed not toothed..... 13 Q. breviloba.

4. Leaves light or blue green, hairy beneath when old, entire wavy or lobed.. 14 Q. undulata.

5. Leaves light or blue green, smooth beneath when old, entire wavy or lobed.. 15 Q. oblongifolia.

II. Leaves or their lobes mostly tipped with bristles, fruit maturing the second season.. Black Oaks.

A. Leaves persistent, densely white, downy beneath ..... 16 Q. hypolerica.

B. Leaves deciduous.

1. Leaves deeply cut or lobed.

a. Leaves lobed to about the middle, lobes wedge shaped; cup of acorn, saucer shaped, thick, about ¾-inch broad ..... 17 Q. rubra.

b. Leaves lobed to beyond the middle or sometimes a few of them not as deeply lobed.

(1) Cup of acorn saucer shaped, thin, enclosing the nut for about 1/3 its length; leaves dull above, cup about ¾′ broad..... 18 Q. Schneckii.

(2) Cup top-shaped or hemispheric, enclosing the nut generally about ½ its length.
(a) Inner bark bright orange, scales of the cup large, forming a loose margin.... 19 Q. velutina.
(b) Inner bark gray, reddish, or yellow, cup less than ¾′ broad ..... 20 Q. Texana.
c. Leaves irregularly lobed with a gray or rusty pubescence beneath..... 21 Q. digitata.
d. Leaves obovate with 3-5 lobes above the middle.
(1) Leaves hairy beneath..... 22 Q. Marylandica.
(2) Leaves smooth beneath..... 23 Q. nigra.
2. Leaves entire or with few teeth.
a. Leaves smooth beneath, sharp pointed, cup very flat..... 24 Q. Phellos.
b. Leaves hairy beneath, cup saucer shaped ..... 25 Q. cinerea.

1. Quercus alba Linnaeus. White Oak. A large forest tree usually 60°-80° in height and trunk diameter of 4° but frequently larger. Trees growing in the open are rather low with round full crown, crowded in the forest they become tall and without branches except at the extreme top. The bark is a light gray, sometimes tinged with brown, flaky without deep fissures except on the lower part of the main trunk. Leaves obovate to oblong, 4′-8′ in length, wedge-shaped at base, 3-9 usually 7 lobed, the lobes entire or with one or two secondary lobes, pale and smooth beneath, bright or dull green above. Flowers appearing before the leaves have reached more than one-fourth their mature size. Acorns stalked or sessile, ovoid to oblong, the cup enclosed from ¼ to ⅓ of its length.

Southern Maine, Ontario, west to Minnesota and south to Florida and Texas. In Texas it extends to the valley of the Brazos.

The wood is heavy, hard, close grained and is very tough, durable, and strong. The heart wood is light brown, the sap wood light. The medullary rays are prominent and the quarter sawed wood is extensively employed in the manufacture of furniture. It is the most valuable timber tree of America.

The wood is used in general construction, finishing, cooperage, wagon and carriage stock, agricultural implements, rail-

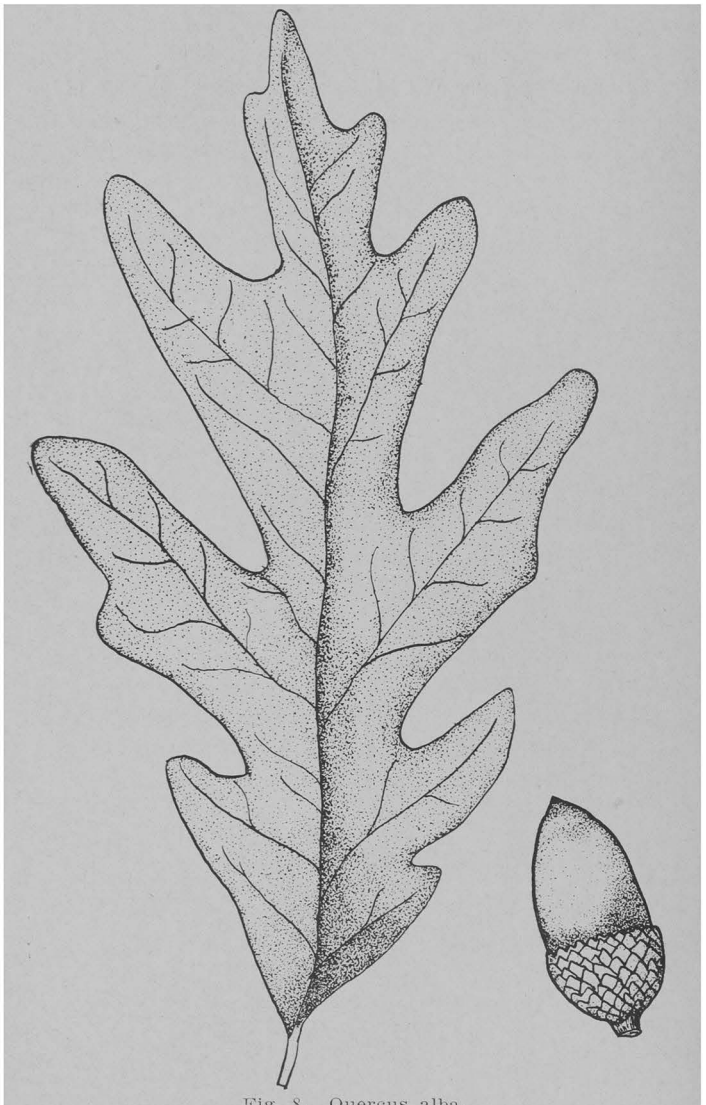


Fig. 8. Quercus alba.

road ties, fence posts, baskets and fuel. The tree is one of great beauty and has no undesirable habits. It is, however,

a slow grower, and is difficult to transplant. It would not be advisable to attempt to cultivate it very far from its natural range. The soil should be rich, moist, well drained. Wherever the tree can be successfully grown its planting should be encouraged.

2. Quercus stellata Wangenheim. Post Oak. A large forest tree reaching 100° in height with diameter of 2°-3°, but generally smaller. The branches are widespreading, forming a

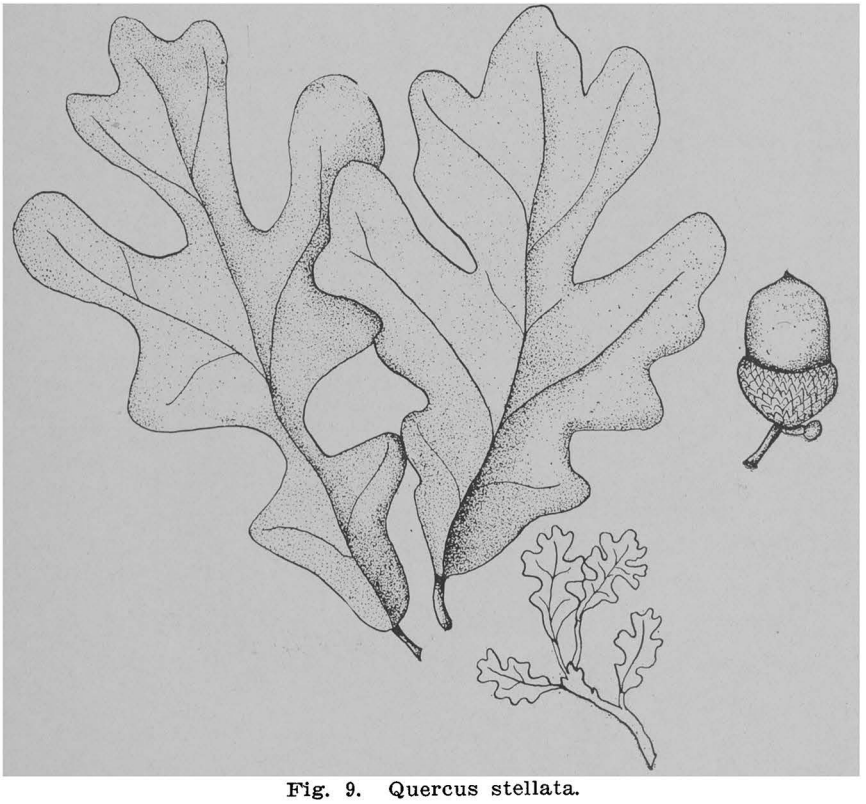


Fig. 9. Quercus stellata.

rounded crown. Bark about one inch thick, reddish, furrowed on main trunk, smooth on young twigs. Leaves obovate, 5-lobed, the middle pair of lobes much larger than the basal, the notch between the lower and middle lobes very deep and wide. The lower lobes are rounded, the upper two or more with secondary lobes. The leaves are thick, firm, dark green above with light stellate hairs, densely hairy beneath with light yellow or silvery hairs. Acorn ovoid about ½′ long, ⅓ to ½ enclosed in the saucer shaped cup.

Massachusetts to Pennsylvania, west to Missouri, south to Florida and Texas. In Texas it extends to the central part of the state. Most abundant in sandy or sterile soils. It is by far the most abundant of any of the oaks in Texas.

The wood is heavy, hard, close grained, durable. It is used for fence posts, cross ties, building material, and fuel. The tree is often planted for ornament, but does not thrive well in heavy soils and is a slow grower.

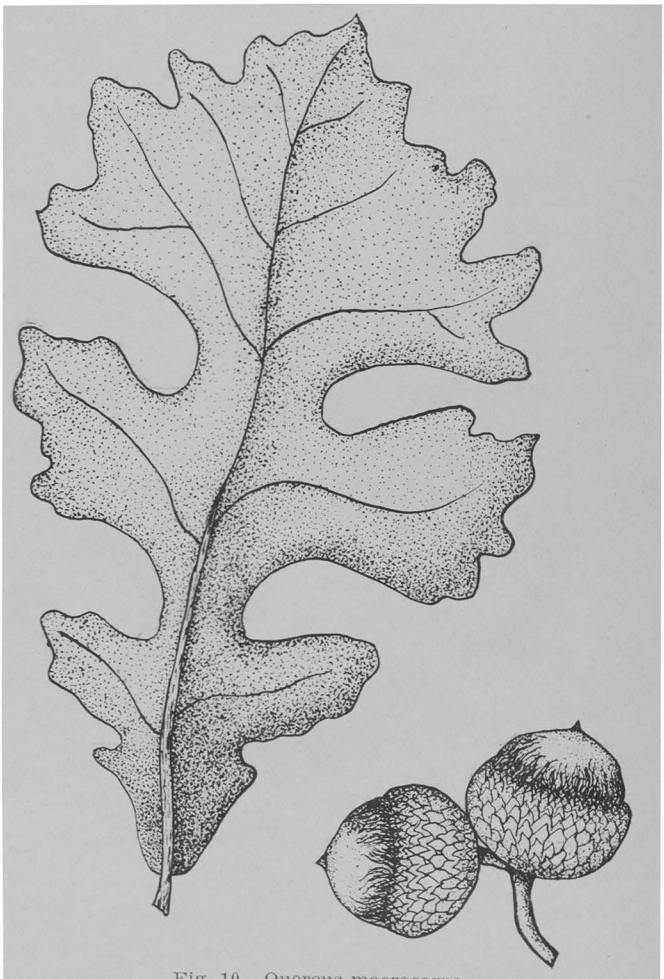


Fig. 10. Quercus macrocarpa.

3. Quercus macrocarpa Micheaux. Burr Oak. Mossy Cup Oak. A large stately forest tree which in its maximum size may reach a height of 170° with trunk diameter of 6°-7°. It is, however, more commonly medium size 40°-60° high. The branches are stout and spreading, forming a wide open crown. Bark 1′-2′ thick, gray to brown, deeply fissured. Leaves obovate or oblong, 4′-12′ long, 5-9 lobed, variable, some of them barely lobed, others cut almost to the midrib, dark green and smooth above, whitish and hairy beneath. Acorn ovoid, ¾′ to 1¼′ long, one-third to almost its entire length enclosed in the cup-shaped cup. The upper edge of the cup is fringed with a mossy border made up of the awned upper scales.

Nova Scotia to Manitoba, Minnesota, Wyoming, south to Georgia, and west Texas. In Texas it extends to the Nueces River.

The wood is similar to that of Q. alba, both being called white oak by lumbermen. The supply of these two valuable timber trees is rapidly diminishing. There remains practically no virgin forests.

4. Quercus lyrata Walter. Overcup Oak. A large forest tree 100° in height and 2°-3° in diameter. The trunk is either tall, erect, or divided into several main branches which are wide spreading, and form a beautiful rounded crown. The bark is one inch or more in thickness, light gray, fissured, and scaly. Leaves obovate-oblong, 5-9 lobed, frequently cut almost to the midrib near the middle, wedge shaped at base, green and smooth above, pale and hairy beneath. Acorns sessile or short stalked, nut globose, depressed, ¾′ long, almost completely enclosed in the rather thin reddish brown cup.

Maryland south to Florida, west to Texas, and north through Tennessee, Indiana, and Illinois. Confined principally to moist soil. In Texas it extends to the Trinity Valley. Most abundant in wet rich alluvial soils.

The wood and uses are similar to Quercus alba. It has been used extensively for railroad ties.

5. Quercus prinoides Willdenow. Chinquapin Oak. A shrub or small tree sometimes reaching a height of 15°-20°. The bark is light brown and somewhat scaly. Leaves obovate or oblanceolate, pointed or acute at the apex, wedge-shaped

or rounded at base, coarsely toothed, green and shining above, hairy beneath with grayish hairs. The acorns are sessile or very short stalked, nut ovoid to oblong ½′ to 1′ long, light

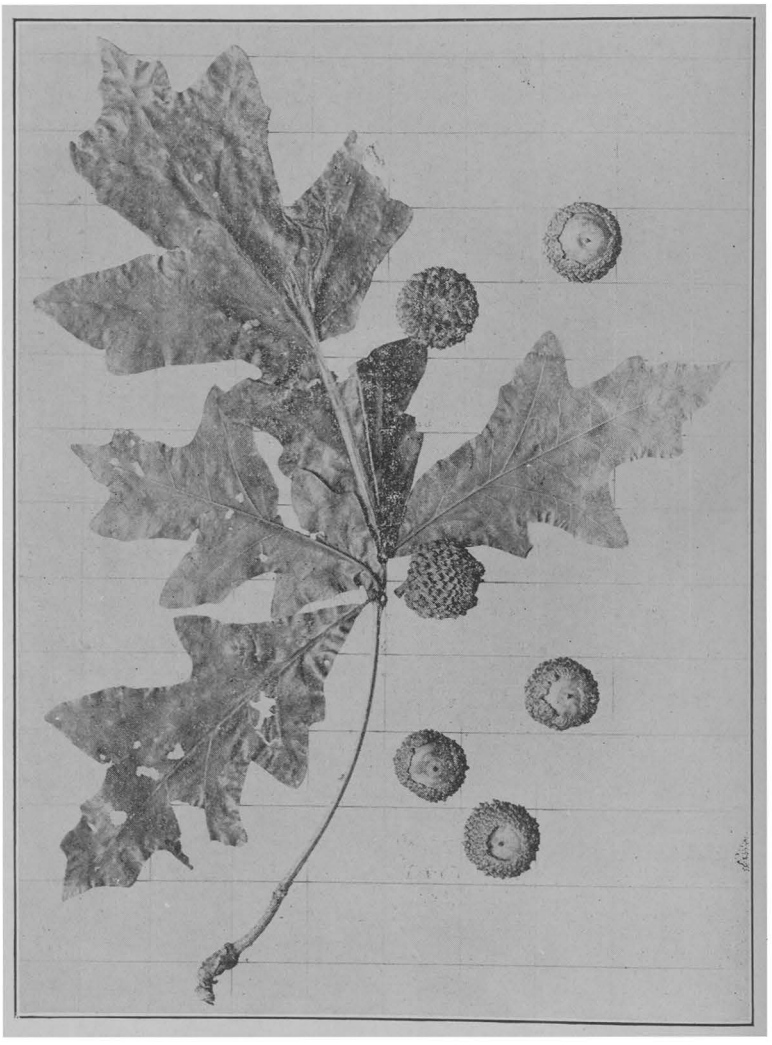


Fig. 11. Quercus lyrata.

brown in color, cup hemispheric ½′ in diameter enclosing about one-half of the nut.

Maine to Minnesota, south to Alabama and Texas.

The trees are too small to be of value for timber. It is used for fuel.

6. Quercus Muhlenbergii Englemann. Yellow Oak. Tan Bark Oak. A large forest tree with maximum height of 100° and trunk diameter of 6°-7°, but usually smaller, 60°-70° high, and 3°-4° in diameter. The branches are spreading, forming a rather broad crown. The bark on old trunks is about 1½′ thick, close, light to dark gray, scaly, sometimes separating in rather large flakes. Leaves with petioles ½′-1¼′ long, obovate to oblong lanceolate, taper pointed, coarsely toothed, teeth incurved, glandular, hairy on both sides when young, smooth above at maturity, hairy below. Acorn ½′-¾′ long enclosed for about one-third of its length by the thin, silvery gray cup-shaped cup. This tree is frequently confused with Quercus prinus from which it may be distinguished by the bark on the mature trunk.

Vermont to Minnesota, south to Florida and west to Texas. It is most abundant on limestone soils.

The wood is heavy, close grained, hard and strong. It is used for the same purposes as Quercus alba.

7. Quercus Michauxii Nuttall. Cow Oak. Basket Oak. A large forest tree reaching a maximum height of 100° with trunk diameter of 6°-7°. The branches are stout and upright, forming a rather narrow rounded crown. The bark is ½′ to 1′ thick, light ashy gray, separating into thin plates. Leaves obovate to broadly oblong with petioles ⅜′-1¼′ long, short taper-pointed at the apex, wedge-shaped or sometimes rounded at base, toothed, smooth and dark green above, paler and densely hairy beneath. Acorns solitary or in pairs, borne on short stalks, nut ovoid 1′-1¼′ long, one-half enclosed in the scaly, pubescent, saucer-shaped cup.

Delaware to Indiana, Missouri, south to Florida and west to Texas. In Texas it extends to the Trinity Valley.

Uses similar to Quercus alba.

8. Quercus Brayi Small. Bray's Oak. A rather large forest tree attaining a height of 50° to 60° with gray, flaky bark. Leaves obovate, somewhat triangular, wedge-shaped toward the base, coarsely wavy toothed, thin, dark green

above, smooth on both surfaces, paler beneath with prominent whitish midrib and relatively few strong regular, prominent lateral veins. The acorns are borne upon short stalks, nut

Fig. 12. Quercus Michauxii.

oblong to ovoid, about one-third enclosed in the thin walled, warty scaled, hemispheric cup.

Occurs only in canyons of central Texas.

9. Quercus Durandii Buckley. Durand's Oak. A tree reaching a maximum height of 40°-50° with trunk diameter of 2°-3°. Bark light gray, somewhat scaly about ½′-¾′ thick.

Leaves entire or sometimes 5-lobed near the blunt apex, wedge-shaped at base, thick, bright, lustrous green above, pale and hairy beneath. Acorns almost sessile, cup shallow, nut ovoid somewhat depressed. Distinguished from Quercus breviloba by the very shallow cup.

Alabama, extending into the eastern part of Texas. It grows in dry soil of river valleys.

Similar to Quercus alba. The tree is also planted for ornament.

10. Quercus Laceyi Small. Lacey's Oak. A small tree 15°-20° high or more frequently a shrub. Bark rough, irregularly and deeply grooved, brown in color. Leaves oblong to oblong-obovate, 3-5 lobed, thick, short stalked, olive green, the upper surface has a waxy appearance while the lower is grayish and covered with minute scales, not falling until about the time the new leaves unfold. Acorns sessile or nearly so, the nut is oblong to oblong-ovoid, enclosed only at the base by the shallow saucer-shaped cup.

Limestone hills of south central Texas. Too small to be of economic importance. Used for fuel.

11. Quercus Virginiana Miller. Live Oak. A large evergreen tree 40°-50° high with trunk diameter of 3°-4°. The stocky stem is buttressed at the base and frequently divides a few feet above the ground into large secondary branches which are widespreading, forming a low rounded crown. Old trees are almost globular in outline. The bark is ½′ to 1′ thick, brown, tinged with red, somewhat furrowed, scaly. Leaves oblong, oval, or obovate, mostly blunt, sometimes short pointed, margins entire on mature branches, somewhat toothed on young branches, dark green above, pale and somewhat hairy beneath. Acorn borne singly or in clusters of two to five, short stalked; the nut is ovoid or oblong, one inch or more long, brown, shining, about one-fourth enclosed in the light brown, turbinate, hemispheric cup.

Virginia to Florida, west to Texas, and Mexico. In Texas it occurs abundantly in the coast country from the Brazos to the Nueces. It extends to the northward across the Black and Grand prairies. The tree grows in a wide variety of soils and habitats. It seems to reach its maximum development in

rather heavy clay soil but thrives well along river bottoms. It is also very drouth-resistant, attaining a considerable size on dry barren hills of central and west Texas.

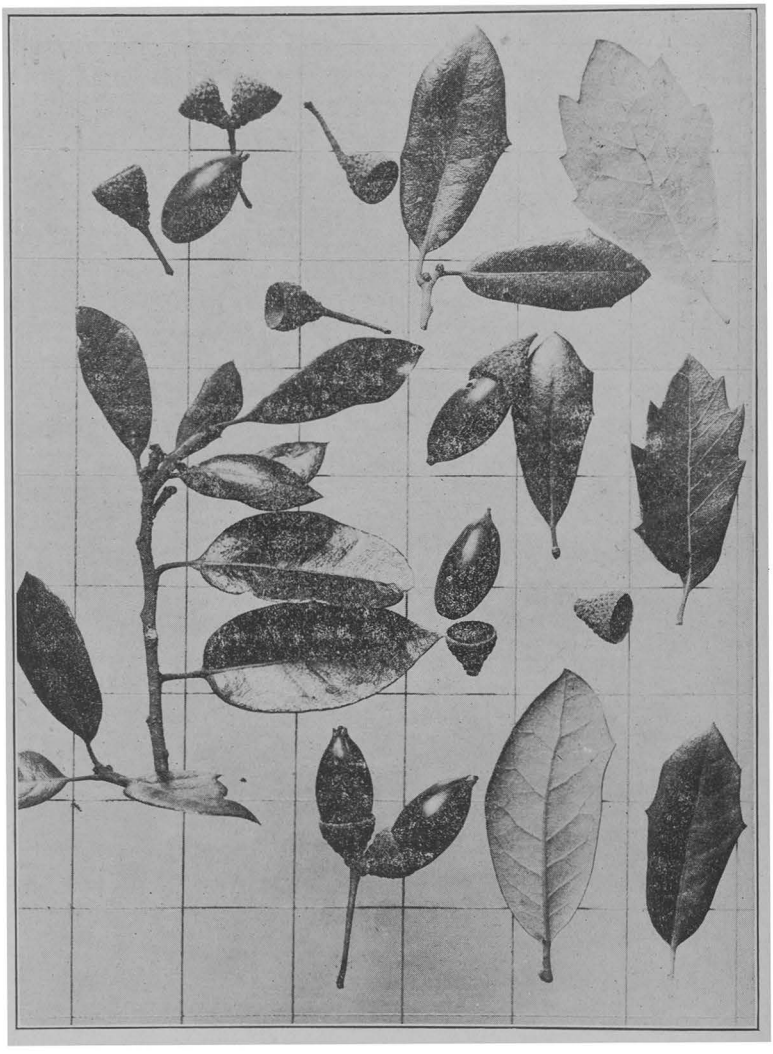


Fig. 13. Quercus Virginiana.

The wood is hard, strong, close-grained. It was formerly used in ship building. The live oak is one of the finest of our ornamental shade trees

12. Quercus Emoryi Torrey. Black Oak. A small round-topped tree 30° to 40° high with short trunk, stout drooping branches and slender reddish branchlets. Bark 1′-2′ thick, deeply divided, dark brown. Leaves oblong, lanceolate, pointed, entire or somewhat toothed, 1′-2½′long, ½′-1′ wide, thick and glossy when mature, persistent until spring. Fruit

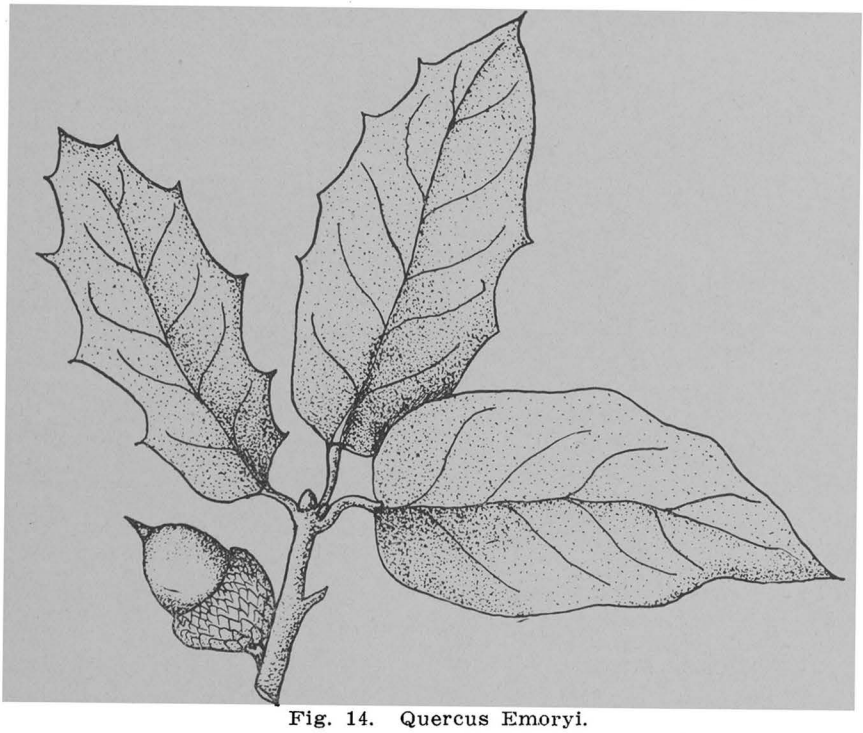


Fig. 14. Quercus Emoryi.

sessile or nearly so, ripening from July to September of the first year; acorn oblong or oval ½′-¾′ long,⅓′ wide, enclosed for about one-third its length in the cup-shaped cup.

On mountain sides and in canyons. New Mexico, Arizona, northern Mexico and Texas. In Texas it occurs in the Limpia and Chisos mountains.

The wood is soft, strong, brittle, close grained, dark brown. The acorns are sweet and edible, being used as food by the Mexicans.

13. Quercus breviloba (Torrey) Sargent. Texan White Oak. A shrub or small tree sometimes reaching a height of 25°-30°. The trunk divides near the base to form several branches. The thin, silvery, gray bark separates from the

trunk in loose, elongated plates. Leaves obovate or oblanceolate, with 5-7 shallow lobes, wedge-shaped at base, bluish green and shining above, paler and hairy beneath, remaining on the tree until the new leaves of the following spring unfold. Acorns sessile or very short stalked; nut ovoid, cup saucer-shaped, scales appressed, encloing about one-fourth of the nut.

West Texas and Mexico. Most abundant in dry limestone soil.

The wood is used for fuel.

14. Quercus undulata Torrey. Shin oak. A shrub or small tree sometimes 25°-30° high with thin scaly gray bark, and reddish brown twigs. Leaves oval to oblong 1′-3′ long. ¼′-¾′ wide entire or with wavy sometimes toothed margin, smooth and lustrous above, yellowish brown beneath, persistent Fruit ripening the first season, solitary or in pairs, sessile or stalked. Acorn oval ¾′-1′ long enclosed for about one-third its length in the cup.

On dry ridges and cliffs, Colorado, New Mexico, Arizona, Utah, Nevada, western Texas, and Mexico.

15. Quercus oblongifolia Torrey. Blue Oak. A small tree usually not over 30° in height, and 18′-20′ in diameter. It branches freely to form a rounded symmetrical crown. The bark is ¾′-1½′ thick, light gray, scaly, the scales are close, regular. Leaves oblong, ovate or oblanceolate, entire or notched at the apex of the undulate margin, bluish green persistent until the new leaves of the following spring. Acorns are sessile or stalked; nut ovoid, dark brown, ½′-¾′ long, about one-third enclosed in the hemispheric, hairy cup.

Chisos Mountains of West Texas, extending into Mexico, Arizona, and New Mexico. The trees are small and are only used for fuel.

16. Quercus hypoleuca Englemann. White Leaf Oak. A shrub or small tree usually not over 30°-40° high with round top, spreading slender branches, and rough fissured dark bark. Leaves lanceolate, elliptic or oblong lanceolate, 2′-4′ long, ½′-1′ wide, with thickened margins, entire or some of them slightly toothed, bristle tipped, yellowish green and lustrous above, whitish and wooly beneath. Fruit ripening in the sec-

ond summer, solitary almost sessile, acorn ovoid 1/2′-2/3′ long about one-third enclosed in the turbinate cup.

Mountains of New Mexico, Arizona, western Texas, and northern Mexico. The wood is heavy, hard, close grained, brown in color.

17. Quercus rubra L. Red Oak. A large forest tree 70° to 80° in height and with trunk diameter of 2° to 4°. Trees growing in dense forests are tall and straight with a rather narrow crown of few branches. Bark on young trees smooth and light gray, on old trunks regularly and coarsely fissured, 1′-1½′ thick, dark brown with a tinge of red. Leaves obovate or oblong 5′-9′ long, 4′-6′ broad with 5-11 coarse toothed bristle tipped lobes, usually divided about half way to the midrib, lobes wedge-shaped tapering from the base, and mostly with three teeth at the apex. Thin and firm, hairy at first becoming smooth, dark green and dull above, pale yellow green below with occasional small tufts of rusty hairs in the axils of the veins. Acorns solitary or in pairs maturing in the autumn of the second season. Sessile or borne on short stalks. The cup is shallow, saucer-shaped enclosing only the base of the nut. Scales closely appressed, bright red brown somewhat glossy. Nut ovoid, flat at the base ¾′-1′ long rounded at the apex, gray or reddish brown, more or less pubescent.

Nova Scotia and Minnesota, south to Florida and Texas.

The wood is heavy, hard, close-grained, strong light reddish brown. It is used for building material, finishing, car and wagon stock. The red oak is also a very desirable tree for ornamental planting. It thrives best in a moist rich soil where it grows rapidly.

18. Quercus Schneckii Britton. Schneck's Oak. A large forest tree 150° high and 4°-6° in diameter, but usually smaller. The trunk is tall and straight with a butressed base. The lower branches are drooping while the upper are widespreading and form a wide, rounded open crown. Bark on young branches smooth and gray, on old trunks dark brown with a tinge of red, fissured, the ridges flat, furrows shallow. The leaves are ovate to obovate 3′-7′ long, wedge-shaped or truncate at base with 5-9 lobes which extend more than half way to the midrib; the lobes are wedge-shaped or oblong usually

toothed, the teeth ending in bristles; thin, bright green, shiny and smooth above, paler and smooth with reddish brown hairs in the axils of veins below, petioles ½′ long. The acorns are borne solitary or in pairs sessile or on very short stalks. Nut ovoid ¾′ long, reddish brown sometimes striped with

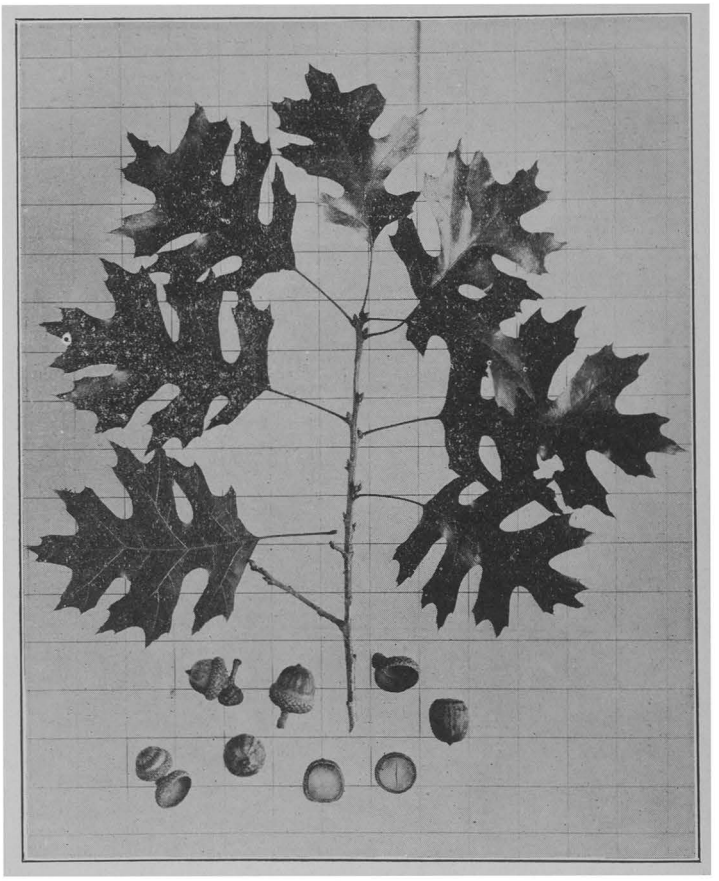


Fig. 15. Quercus Schneckii.

darker lines, somewhat hairy, enclosed for about one-third its length in the saucer-shaped cup which is rounded or nearly flat.

Iowa, Illinois, and Indiana sou'h to Florida and Texas.

Uses similar to Quercus rubra.

19. Quercus velutina Lamark. Black Oak. A large forest tree 150° high and 3°-4° in diameter, but usually smaller, 70°-80° high. The branches are slender, ascending, and with stout branchlets form a widespreading, rounded crown. Bark on trunks thick, deeply fissured, not scaly, dark brown or

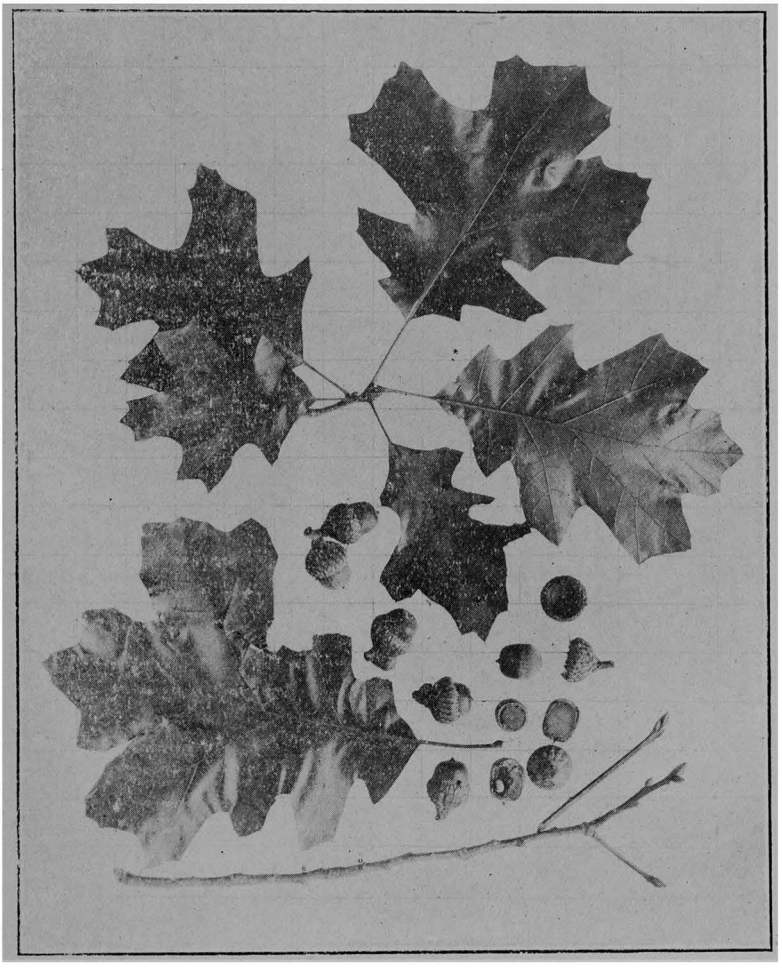


Fig. 16. Quercus velutina.

almost black, inner bark deep orange. Leaves obovate to oblong, quite variable in size, and from 5′-7′ long, 5-9, most generally 7-lobed, the openings between the lobes are wide and rounded, sometimes extending almost to the midrib; lobes broad, oblong to triangular, bristle tipped, usually wedge-

shaped at base, thin and firm at maturity, smooth glossy, bright green above, paler or yellow green and smooth below or with hairs in the axils of the veins. The acorn sessile or nearly so, solitary, or in pairs. Nut subglobose, ovoid or oblong, ½′ to ¾′ long, somewhat hairy, especially at the summit, enclosed for about one-half its length in the deeply cup-shaped cup; kernel yellow, bitter. The scales of the cup are coarse, loose above the middle, thin sharp pointed forming a fringed border to the rim.

Maine to western Ontario, south to Florida and Texas. It occurs in east Texas and in rocky ravines and mountains near the mouth of the Pecos.

The wood is coarse grained, strong, light reddish brown. The wood is not usually distinguished from the red oak commercially, but it is inferior in quality. Its uses are similar to Q. rubra.

20. Quercus Texana Buckley. Texan Oak. Red Oak. Spotted Oak. Spanish Oak. A small tree, with spreading branches forming a rounded crown. The bark is light brown, somewhat scaly on older portions, thin and smooth on young branches. Leaves oblong to obovate, 2′-4′ in length, with 3-7 triangular to ovate lobes, the terminal lobe much larger than the others; lobes sometimes toothed, bristle tipped; deep green, smooth, shining above, paler, yellowish below, with prominent red venation. Acorns sessile or on very short stalks; nut ovoid-oblong or oblong, light brown, enclosed for about one-third its length in the hemispheric cup; scales of the cup ovate, blunt, forming a fringe around the rim of the cup.

In dry rocky soils of southern and western Texas.

The wood is close grained and hard. It is used for fuel.

21. Quercus digitata Sudw. Spanish Oak. A forest tree 70°-80° high with trunk diameter of 2°-3°. The branches are stout, spreading, and form a loose open crown. The bark is ¾′-1′ thick, dark brown, fissured, the furrows usually narrow, sometimes wide, ridges rather broad, broken into short plates; young shoots at first hairy greenish red or gray brown, becoming smooth and dark gray brown. Leaves oblong or

obovate, quite variable in outline, 3′-9′ long; somewhat curved, wedge-shaped, rounded or truncate at the base, 3-11, usually 5-9 lobed; the number of lobes more variable than in any other of the oaks; the middle lobe is generally longer than

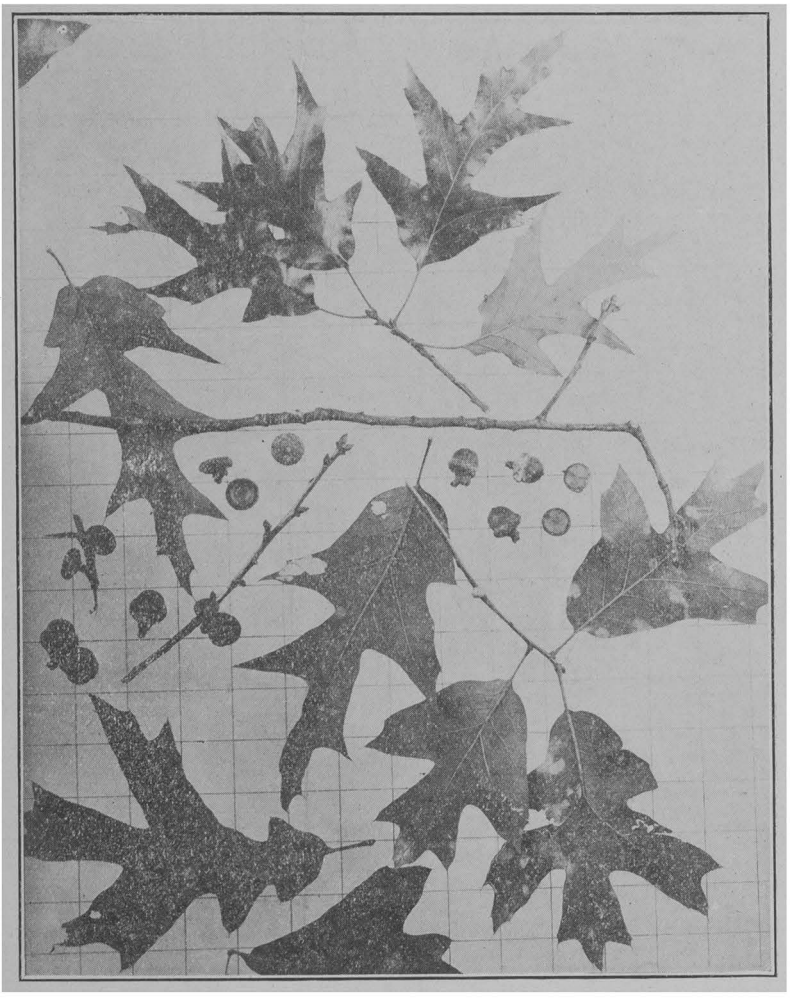


Fig. 17. Quercus digitata.

any of the others, but the terminal lobe is frequently much elongated and scythe-shaped. Acorns borne sessile or almost so; nut subglobose, ⅜′ long, more or less hairy, light brown, enclosed for about one-half its length in the cup-shaped cup; scales of cup thin, oblong, reddish and hairy.

New Jersey to Missouri, Florida and Texas. In Texas it extends to the valley of the Brazos.

Its uses are similar to Quercus rubra. The tree is planted for ornament and shade, for which it is well adapted.

22. Quercus Marylandica Muenchaussen. Black Jack Oak. Black Jack. A forest tree 40°-50° high with trunk diameter of 18′, but usually much smaller. The branches are short, stout, often contorted and form a compact rounded crown. Bark 1′-1½′ thick, black, very rough on mature trunks. Leaves broadly obovate 6′-7′ long, 3-5 lobed, narrowly rounded or

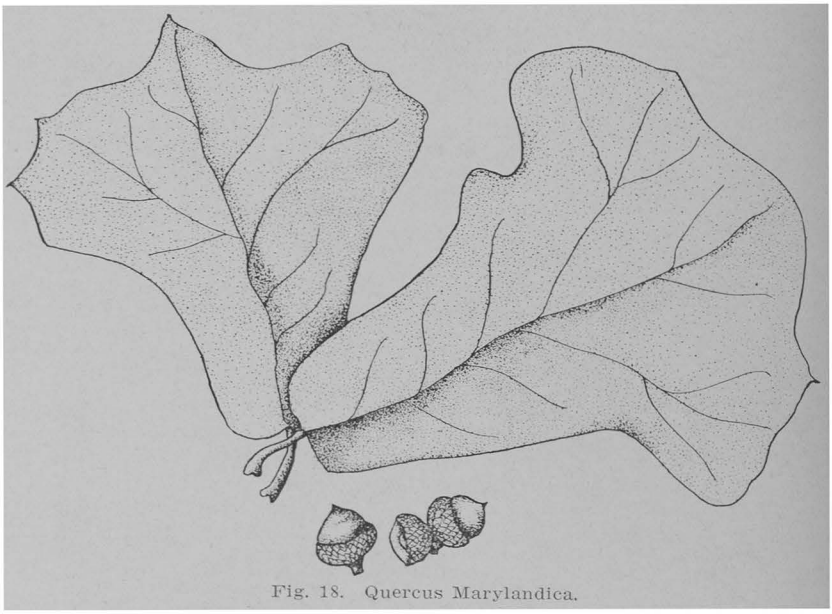


Fig. 18. Quercus Marylandica.

heart-shaped at base, thick almost leathery, deep green and smooth above, paler pubescent and with prominent venation below; the notches between the lobes quite variable, frequently only undulate lobed; lobes bristle tipped. Acorns borne solitary or in pairs sessile or nearly so; nut subglobose or ovoid ¾′ long, hairy, light yellow brown sometimes striate; enclosed for about two-thirds its length in the top-shaped cup; scales of cup blunt, light or reddish brown, hairy, rather loose particularly near the top.

New York to Pennsylvania, Indiana and Nebraska, south to Florida and Texas.

The wood is of little value except for fuel.

Fig. 19. Post oak trees in winter.

23. Quercus nigra L. Water Oak. A round topped forest tree sometimes 80° high with slender branches, smooth, light brown bark and reddish twigs. Leaves oblong some of them

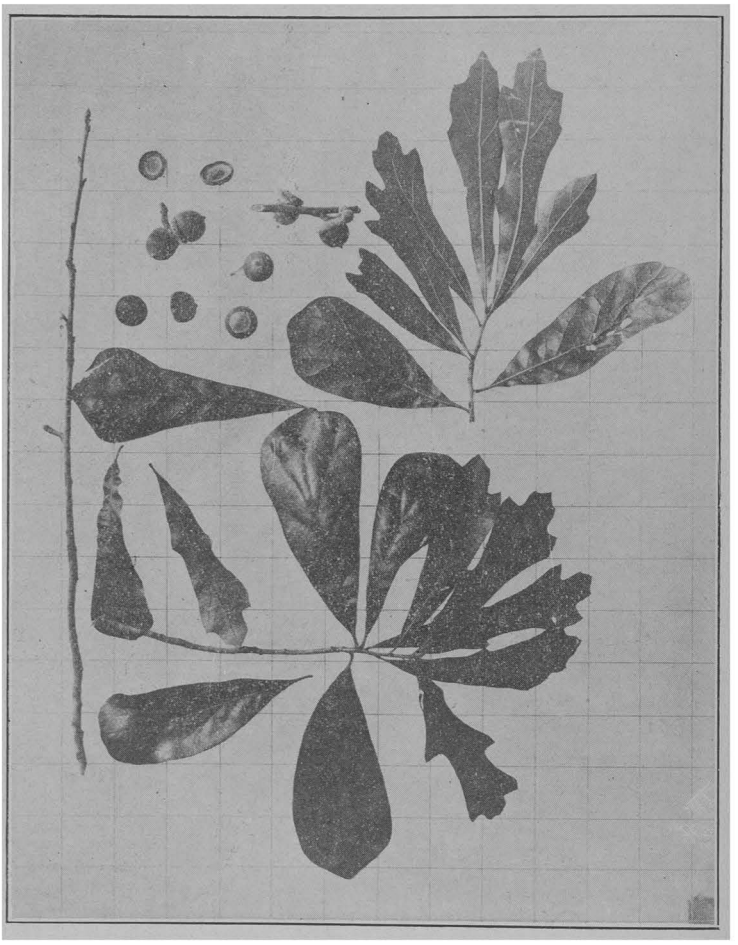


Fig. 20. Quercus nigra.

three or more lobed toward the apex and linear-obovate, 2½′-6′ long, 1½′-2½′ wide, dull green above, paler below, petioles short. Fruit solitary or in pairs, sessile or short stalked; acorn ovoid 1/2′-2/3′ long and almost as wide, enclosed at the base in a thin saucer-shaped cup, often striate.

Delaware, Florida, west to the Colorado River, Texas.

The wood is heavy, hard, close grained and strong. It is used for fuel.

24. Quercus Phellos L. Willow Oak. A forest tree 70°-80° high, with trunk diameter of 2°-4°. The branches are small and form a rather narrow, open rounded crown. The bark is thin, ½′-¾′ thick, light reddish brown, smooth on young branches, shallowly fissured on old trunks. Leaves

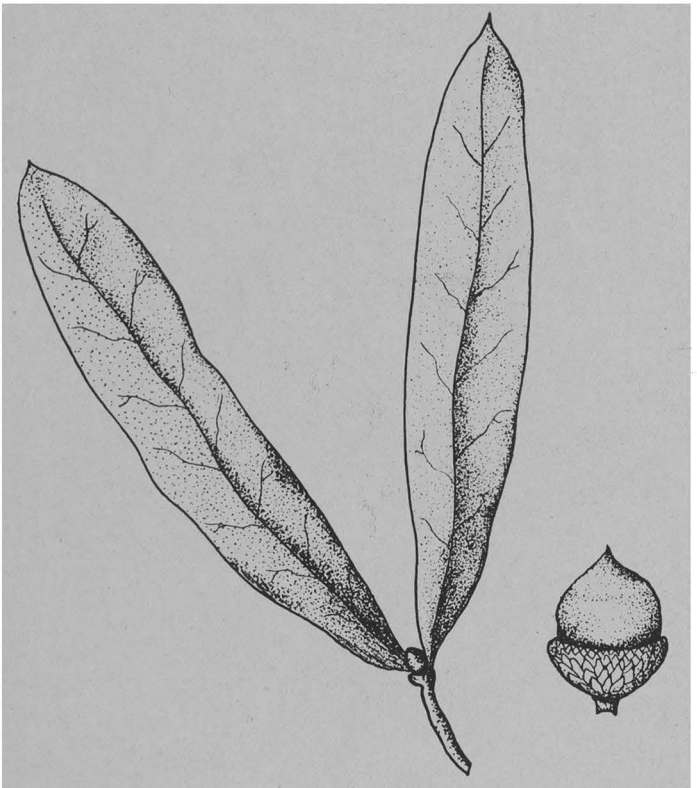


Fig. 21. Quercus Phellos.

linear oblong, ovate lanceolate or sometimes lanceolate-obovate, acute at both ends often falcate, entire or undulate margin, 2½′-5′ long, ½′-1′ wide, borne on short petioles, thick, smooth and shining above, paler and somewhat hairy beneath. Acorns borne usually solitary, sessile or very short-stalked; nut subglobose or hemispherical, covered with pale pubescence,

inclosed only at the base in the shallow saucer-shaped cup; scales of cup close, thin, hairy dark reddish brown.

New York to Florida, west to Kentucky, Missouri and Texas. It prefers wet sandy soil and is found principally along swamps, but sometimes occurs on highland. In Texas it extends to the Sabine River.

The tree has been planted extensively for ornament. It is hardy as far north as southern New England. The wood is used in somewhat the same way as Quercus rubra.

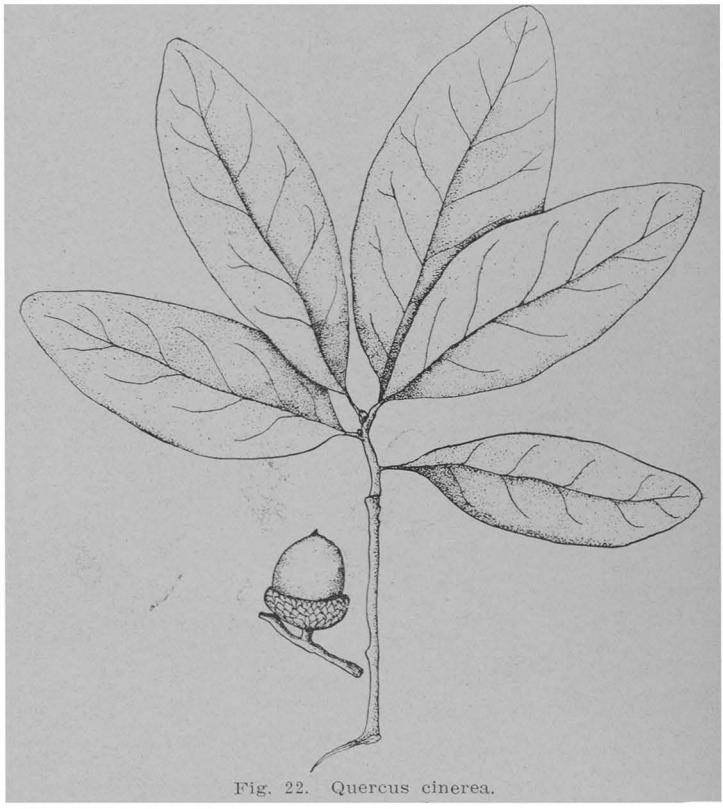


Fig. 22. Quercus cinerea.

25. Quercus cinerea Michaux. Upland Willow Oak. Blue Jack Oak. A tree usually 15°-20° high with trunk diameter of 5′-6′, but sometimes larger, 50°-70° high. The branches are stout and stiff, forming a rather narrow irregular crown. Some

Fig. 23. A mixed forest of pine and upland oak (Bray Bulletin 47 Bureau of Forestry, U. S. Dept. Agr.).

Fig. 24. Forest of Quercus Michauii or the Trinity River (Bray Bulletin 47 Bureau of Forestry, U. S. Dept. Agr.).

trees are broad and rounded. The bark is ¾′-½′ thick, divided into small angular plates, covered with black scales. Leaves oblong-lanceolate to oblong-obovate 2′-5′ long, ½′-1½′ wide, entire or with undulate margins, sometimes slightly lobed near the apex, blue green above, pale hairy beneath, slightly bristle tipped. Acorns borne sessile, produced in great numbers; nut oblong to subglobose, ½′ long, light brown often striate, hoary pubescent at the apex; cup saucer-shaped enclosing the nut only at the base or for about one-half its length.

North Carolina to Florida and west to Texas. It occurs principally on sandy uplands, mostly near the coast. In Texas it extends to the valley of the Brazos.

The wood is hard, close grained, strong. It is used principally for fuel. The trees of our area are small.

MORACEAE. The Mulberry Family.

Trees with milky sap; leaves simple, alternate, two ranked, serrate entire or variously lobed, 3-5 veined at the base; flowers borne in ament-like spikes or heads on the outside of a receptacle or on the inside of a closed receptacle; fruit compound, drupaceous.

1. Flowers on the outside of the receptacle.
   a. Flowers all in spike like catkins, fruit an elongated edible berry somewhat resembling the blackberry..... 1. Morus.
   b. Pistillate flowers in heads, fruit globose, not edible.
      (1) Branches armed with thorns, leaves entire ..... 2. Toxylon.
      (2) Branches unarmed, leaves serrate or lobed ..... 3. Broussonetia.
2. Flowers borne inside a hollow receptacle..... 4. Ficus.

1. **MORUS.** The Mulberries.

Trees with edible fleshy fruit, milky juice; flowers monoecious or dioecious; leaves often deeply irregularly lobed.

Leaves rough above, pubescent beneath, fruit red or purplish..... 1. M. rubra.
Leaves smooth on both sides or nearly so.
Leaves large 2-½'-6' long..... 2. M. alba.
Leaves small 1-½' long, ¾' wide..... 3. M. microphylla.

1. Morus rubra L. Red Mulberry. A tree 60°-70° high, and 3°-4° in diameter. The trunk is generally short and the branches stout, forming a dense rounded broad crown. The bark is dark brown somewhat tinged with red, ½'-¾' thick, fissured into long thin plates. Leaves broadly ovate or ovate-

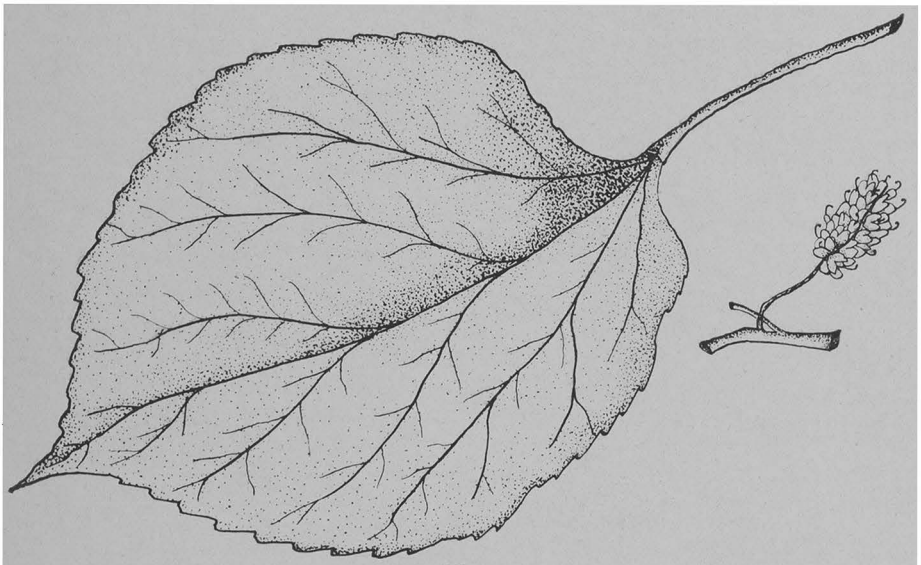


Fig. 25. Morus rubra.

orbicular, contracted at the apex into a long point, heart-shaped or rounded at base, coarsely serrate, frequently 2-7, mostly 3, lobed, smooth above, hairy beneath, thin, dark bluish green, turning yellow before falling from the tree. The flowers appear with the opening of the leaves; pistillate aments about half as long as the staminate. Fruit cylindric about ½'-1½' long, dark purple or almost black when mature.

Massachusetts to Ontario; Michigan and Nebraska, south to Florida and Texas. Occurs most frequently in moist situations. In Texas it extends to the valley of the Colorado River.

The wood is light, soft, but tough, takes a high polish, durable in contact with the soil. It has been used for cross ties

and posts, but the supply is not sufficient to be of much economic importance. The tree is hardy and easily transplanted. It has been extensively planted for ornament.

2. Morus alba L. White Mulberry. A tree reaching a height of 40°-60° with diameter of 2°-3°, but usually smaller.

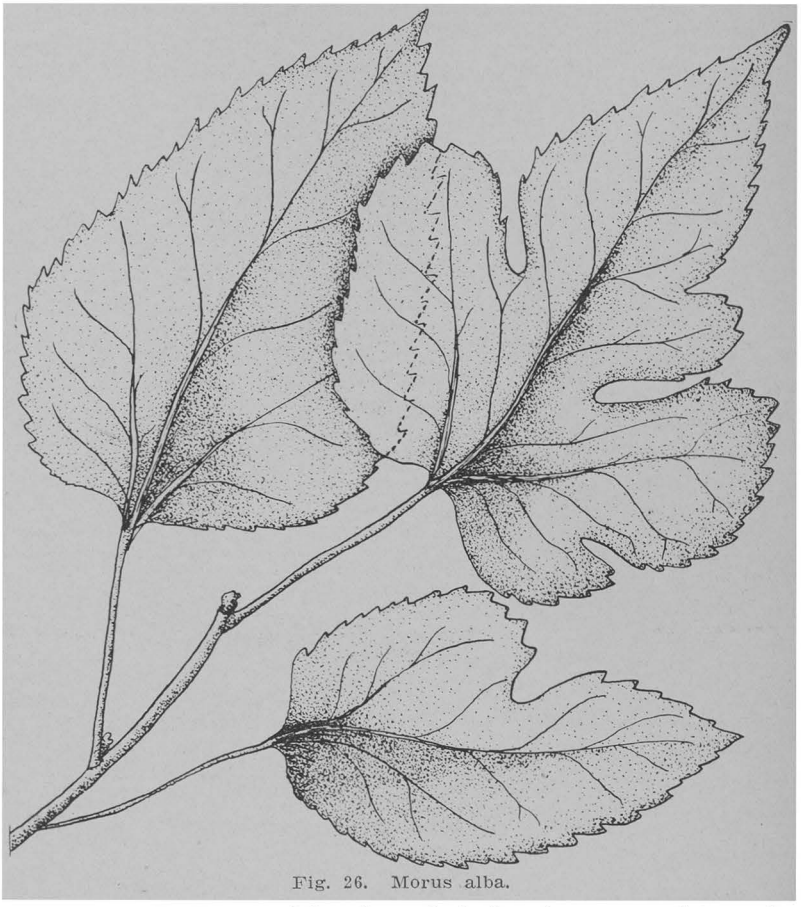


Fig. 26. Morus alba.

The trunk is short and low branched, forming a round topped crown. Bark thin, light gray, furrowed into rough ridges. Leaves thin, firm, ovate or ovate oval, sharp-pointed at the apex, heart-shaped or rounded at the base, serrate, sometimes lobed, smooth, light green above, paler and hairy along the veins below. The staminate aments are slender, drooping,

the pistillate, ovate, shorter. The fruit is white, or pinkish, sweet, edible, insipid.

Introduced from Europe, where the leaves are used for feeding the silk worm. It has been extensively planted for ornament, and thrives best in rich moist soil. It grows well, however, on the dry prairies.

3. Morus microphylla Buckley. Texan Mulberry. A small tree or shrub sometimes 30° high and 12′-14′ in diameter with slender branches. The bark is smooth, thin, ½′ thick or less, light gray, fissured with surface scales. Leaves ovate,

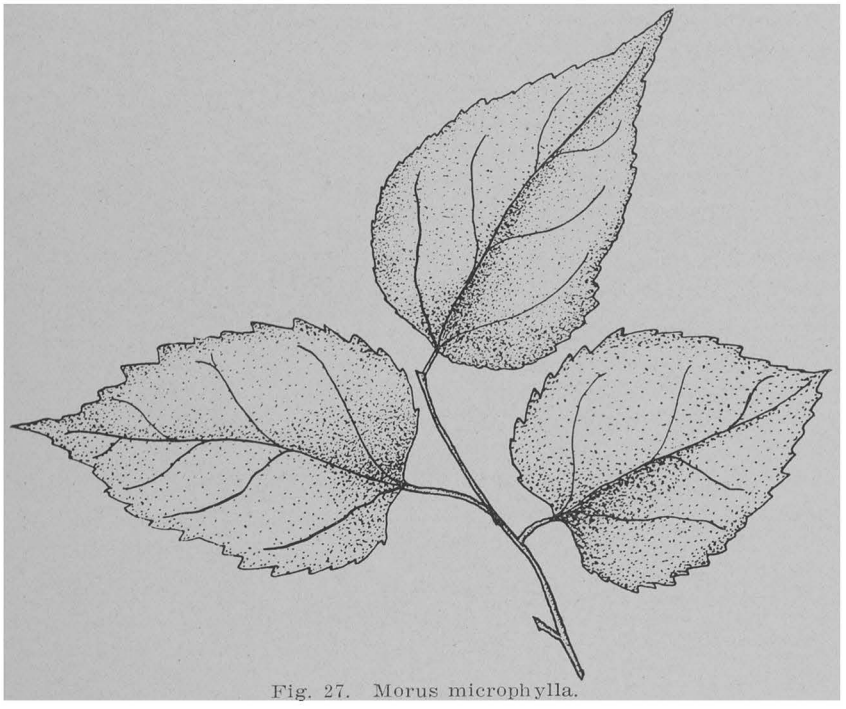


Fig. 27. Morus microphylla.

rounded or sharp-pointed at the apex, serrate, heart-shaped at base, occasionally lobed, thin and firm, dark green, roughened above, paler and hairy along the midribs below, 1½′ long, ¾′ wide. Flowers are borne in short spikes. Fruit dark purple to black with light brown, thick walled seeds, edible.

Texas to Arizona and Mexico. In Texas it occurs principally near the Mexican border.

2. **TOXYLON** Raf. Osage Orange.

Small trees with alternate, simple, entire leaves, milky juice and axillary thorns.

1. Toxylon pomiferum Raf. Osage Orange. A small thorny tree which may reach a height of 50°-60° with trunk diameter of 2°-3°, but usually smaller. Bark 2/3′-1′ thick with broad rounded ridges, somewhat shreddy, brown. The spines are about ¾′ long, and produce painful wounds. The leaves are ovate lanceolate, entire, long pointed, smooth, and glossy green above, 3′-5′ long, 2′-3′ wide. The staminate flowers are borne in elongated catkins, the pistillate in rounded heads. The fruit is yellowish green, resembling an orange, outer coat rough, about 4′ in diameter.

Missouri and Kansas, south to Texas.

The wood is heavy, hard, strong and durable in contact with the soil. It is extensively used for fence posts. The tree has been extensively planted in the prairie regions for hedge fences. When well pruned and taken care of ,it makes a thick almost impenetrable barrier for all kinds of animals. Now largely superceded by wire fences. Not so well adapted for ornamental hedges as many other shrubs.

3. **BROUSSONETIA** Ventenat. Paper Mulberry.

Broussonetia papyrifera Ventenat. A small tree with greenish gray bark, milky juice and stout hairy twigs. Leaves thin, 3-5 lobed or sometimes with only one lateral lobe, rough above, hairy below, borne on long stalks. Flowers diecious, the pistillate in dense round heads on one tree, the staminate in catkins on another. Fruit a globular aggregate of small red drupelets ½′-1′ in diameter.

Native of Asia, introduced and growing spontaneously in this country.

The fibrous inner bark is used in the manufacture of paper.

4. **FICUS** (Tournefort) L. The Figs.

Trees, shrubs or woody climbers with milky sap; thick, leathery mostly alternate lobed leaves; flowers borne in a receptacle, usually dioecious.

Ficus carica L. Common Fig. A shrub or round topped, small tree with short trunk, close, smooth, reddish or gray bark and stout, pithy twigs. Leaves large, thick, firm, leath-

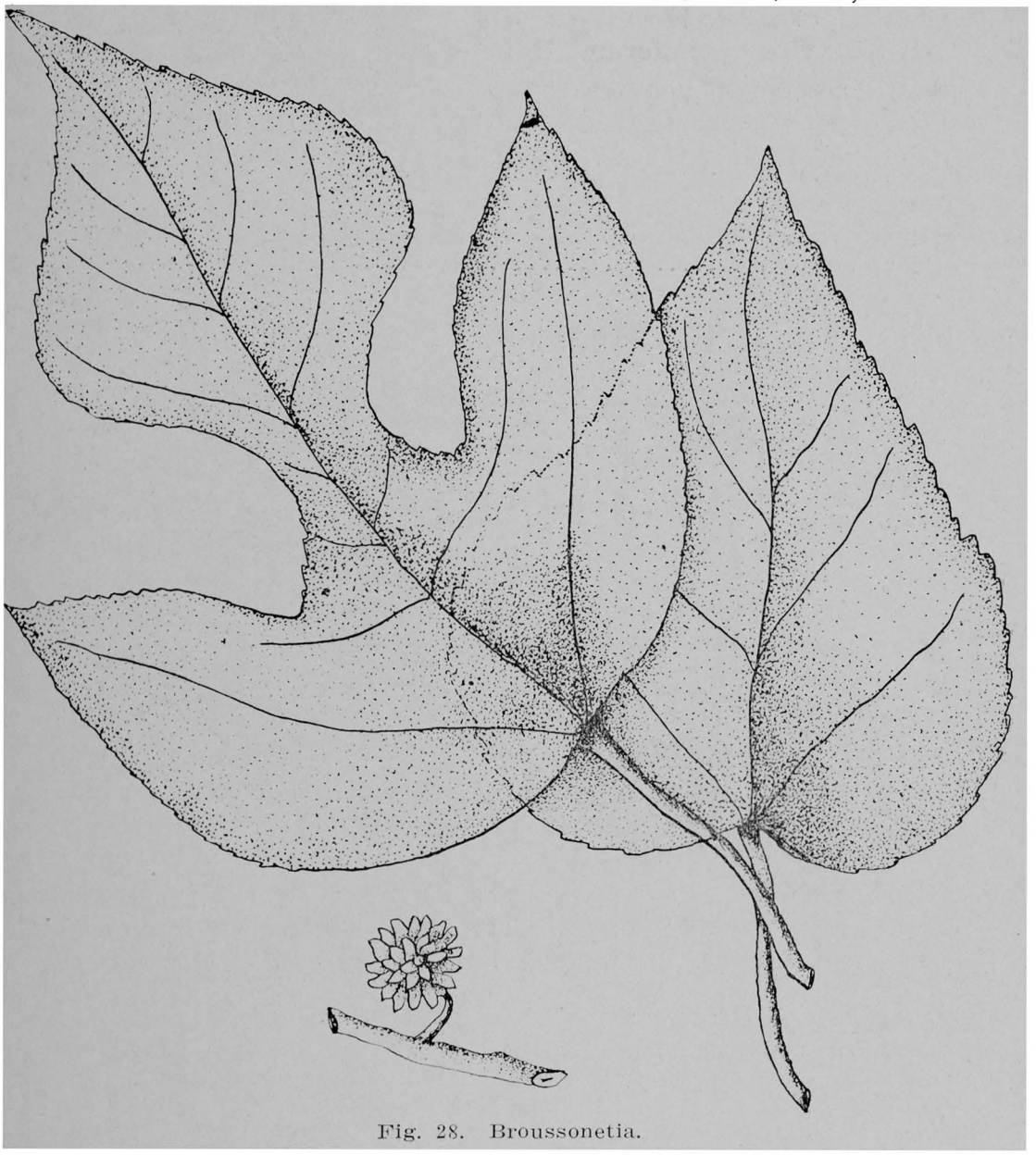


Fig. 28. Broussonetia.

ery, suborbicular or oval, deeply 5-7 lobed, rough and hairy above, pale and hairy beneath. Flowers dioecious, the staminate usually absent in the cultivated form. Fruit pear-shaped, with soft, sweet edible flesh.

A native of the Mediterranean region, extensively planted in our area for fruit and ornament.

ULMACEAE Mirbel. The Elm Family.

Trees with watery juice; leaves alternate, simple, serrate, pinnately veined; flowers small and without the corolla; fruit a samara, drupe or small nut.

Leaves with one primary vein at base, lateral veins parallel.
Fruit a samara winged all the way around.... 1. Ulmus.
Fruit a small nut with soft tubercles..... 2. Planera.
Leaves 3-veined at the base, fruit a fleshy, juicy drupe ..... 3. Celtis.

1. ULMUS L. The Elms.

Trees with deeply furrowed bark; leaves simple, alternate two ranked, doubly serrate, taper pointed, unequal at base, lateral veins prominent and parallel; flowers small clustered appearing in the spring before the leaves in all except one species; fruit a samara surrounded by a wide membranous wing.

Flowers opening in the autumn, borne in the axils of the leaves of the season..... 1. U. crassifola.
Flowers opening in the spring before the leaves.
Branches corky winged..... 2. U. alata.
Branches not corky winged.
Leaves smooth or somewhat roughened above, inner bark not mucilaginous... 3. U. Americana.
Leaves very rough above inner bark, mucilaginous ..... 4. U. fulva.

1. Ulmus crassifolia Nuttall. Cedar Elm. A forest tree sometimes reaching a height of 80° with trunk diameter of 2°-3°, but usually smaller. The branches are usually widespread and droop, forming a flat topped wide crown. Leaves oblong-oval with rounded apex and unequal base, finely doubly serrate, very rough and dark green above with soft pubescence below, 1′-2′ long, ½′-1′ wide. The flowers appear in the autumn in the axils of the season's leaves. They are borne in clusters of three to five. The fruit ripens in September or sometimes in November, depending upon the time of flowering. The bark is light brown, tinged with red,

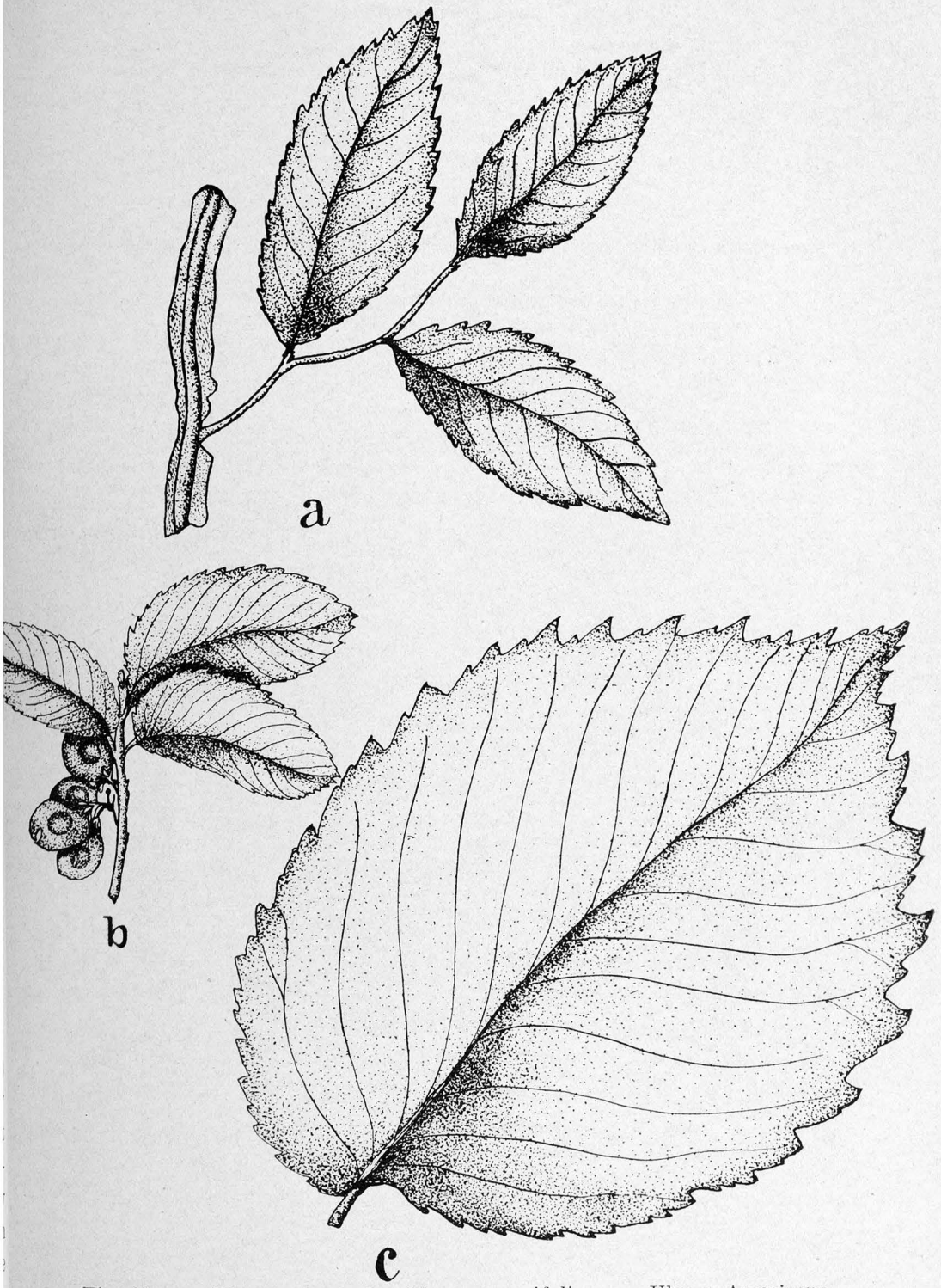


Fig. 29. a. Ulmus alata. b. Ulmus crassifolia. c. Ulmus Americana.

about one inch thick, deeply fissured, the furrows interrupted, the ridges broad and flat.

Southern Arkansas to Mississippi, Texas, and Mexico. It is the commonest elm tree of our area, and reaches its maximum size along the Guadalupe and Trinity rivers.

The wood is reddish brown, heavy, hard, strong and brittle. It is used for hubs, furniture, and fencing. The tree is freqnetly planted for ornament and shade.

2. . **Ulmus alata** Michx. Winged Elm. A forest tree 40°-50° high and with a trunk diameter of 2° or less. The branches are short, stout, ascending and form a rather open crown. Bark thin, with shallow fissures, light reddish brown with flat ridges. The young twigs develop corky wings which are persistent. Leaves ovate-oblong to oblong-lanceolate, somewhat scythe-shaped, rather sharp-pointed at the apex, 1½′-3′ long, wedge-shaped or rounded at the base, doubly serrate, the teeth curved inward, thick and firm almost smooth above, pubescent below. The flowers are borne in the early spring before the leaves unfold. The fruit is ripe at about the time the leaves appear.

Virginia, Indiana, Illinois and Kansas, south to Florida and west to Texas. It thrives best in dry soil. In Texas it extends to the valley of the Trinity River.

The wood is heavy and hard, but not strong, close grained. It is used for hubs, handles for implements and fuel. The tree is extensively planted for shade and ornament throughout its range.

3. **Ulmus Americana.** White Elm. American Elm. A large forest tree sometimes 100°-120° feet high and 6°-11° in diameter. The branches are upright, gradually spreading to form a wide spread rounded crown of great beauty. Bark ashy gray, 1′-1½′ thick, deeply fissured, with rather broad ridges. Leaves oval to obovate-oblong, 2′-5′ long, dark green, and somewhat rough above, paler and smooth or pubescent below, abruptly pointed at the apex, unequal at base, sharply doubly serrate. The flowers are clustered, borne on slender stalks, opening in early spring before the leaves. The fruit ripens with the unfolding of the leaves.

Quebec to Florida, west to Nebraska and Texas. The trees

of our area are not so large and ornamental as the trees growing in the northeastern states.

The wood is hard, tough, flexible, and difficult to split. It is used for agricultural implements, hubs, crates, staves, and heading. It is also used extensively in furniture making, as it takes stains very well. The tree has been a great favorite for shade tree planting. It grows rapidly. The American elm is one of our most beautiful native trees, and its planting should be encouraged.

4. Ulmus fulva Michaux. Slippery Elm. Red Elm. A forest tree 60°-70° high with trunk diameter sometimes reaching 2°, usually smaller. The branches spread to form a broad open flat-topped crown. Bark deeply fissured, reddish brown, the inner layer fragrant and mucilaginous. Leaves ovate-oblong, 4′-6′ long, coarsely doubly serrate, rounded on one side at base, oblique on the other, thick dark green, very rough above, more or less pubescent beneath. The flowers appear before the leaves in the early spring and the fruit ripens when the leaves are about one-half their mature size.

Quebec to Florida, west to North Dakota, Nebraska and Texas. It extends to the valley of the San Antonio River.

The wood is hard, strong, light, durable when exposed in the soil. It is used for cross ties, fence posts and otherwise as Ulmus Americana.

2. PLANERA Gmelin. Planer Tree.

Planer aquatica Gmelin. A small tree 30°-40° high and 20′ in diameter with low broad crown and slender branches. Bark thin, about ¼′, light brown, falling away in large scales. Leaves ovate-oblong, rounded or unequally wedge-shaped at base, pointed or rounded at the apex, toothed, 2′-2½′ long, ¾′-1′ wide, dark green above, paler below. Flowers of two kinds, the stamen bearing or staminate are borne on wood of the previous year, the pistil bearing or pistillate in the axils of leaves of the current season. The fruit is a nut-like structure covered with elongated projections, ripening in the spring. The tree resembles the elms, but may be readily distinguished by the fruit.

North Carolina to Florida and west to Texas. It extends into Texas as far as the Trinity River.

The wood is of no economic value.

3. **CELTIS** (Tournefort) L. The Hackberries.

Trees or shrubs with simple alternate leaves, smooth, thin or warty bark, and scaly buds. The leaves are 3 rarely 4-5 veined at the base, entire or toothed; staminate flowers borne in clusters, pistillate solitary or few together in axils of the leaves; fruit an ovoid or globose drupe with thin sweet pulp and wrinkled bony stone. The drupe hangs on the tree until early spring. The hackberry is our commonest shade tree.

1. Leaves sharply and coarsely serrate..... 1. C. occidentalis.
2. Leaves entire or with only a few teeth.
   - a. Leaves densely gray tomentulose beneath, few toothed, somewhat heart-shaped at base..... 2. C. Helleri.
   - b. Leaves smooth or nearly so beneath.
     - (1) Leaves thick, strongly reticulate veined with a few teeth..... 3. C. reticulata.
     - (2) Leaves thin, entire, slightly curved lanceolate to ovate lanceolate..... 4. C. Mississippiensis.

1. Celtis occidentalis L. Hackberry. White Hackberry. Usually a small tree 30°-40° high and 1°-2° in diameter, but occasionally much larger. The trunk branches a few feet from the ground into a few large limbs. The small branches are horizontal, forming a broad rounded crown. Bark on young twig green, somewhat hairy, becoming reddish brown; on old trunks thick, light brown or silver gray, with short ridges or warty excrescences. Leaves ovate, 2¼′-7′ long, usually long taper pointed, slightly heart-shaped or unequal at base, usually sharply toothed occasionally entire margined, thin, smooth or nearly so above, hairy beneath. The flowers appear during April and May, they are small and inconspicuous. The fruit is a globular drupe ¼′ long, dark purple. It is sweet and edible. The tree is known in some localities as sugar berry.

St. Lawrence Valley to the Gulf States, and west to Texas and Manitoba. It occurs only in the eastern part of Texas.

The wood is yellowish white, heavy, but not strong. It resembles the ash somewhat and is used for the same purposes. The tree is also planted for shade and ornament.

2. Celtis Helleri Small. Heller's Hackberry. A small tree with maximum height of 30°-40° and trunk diameter of

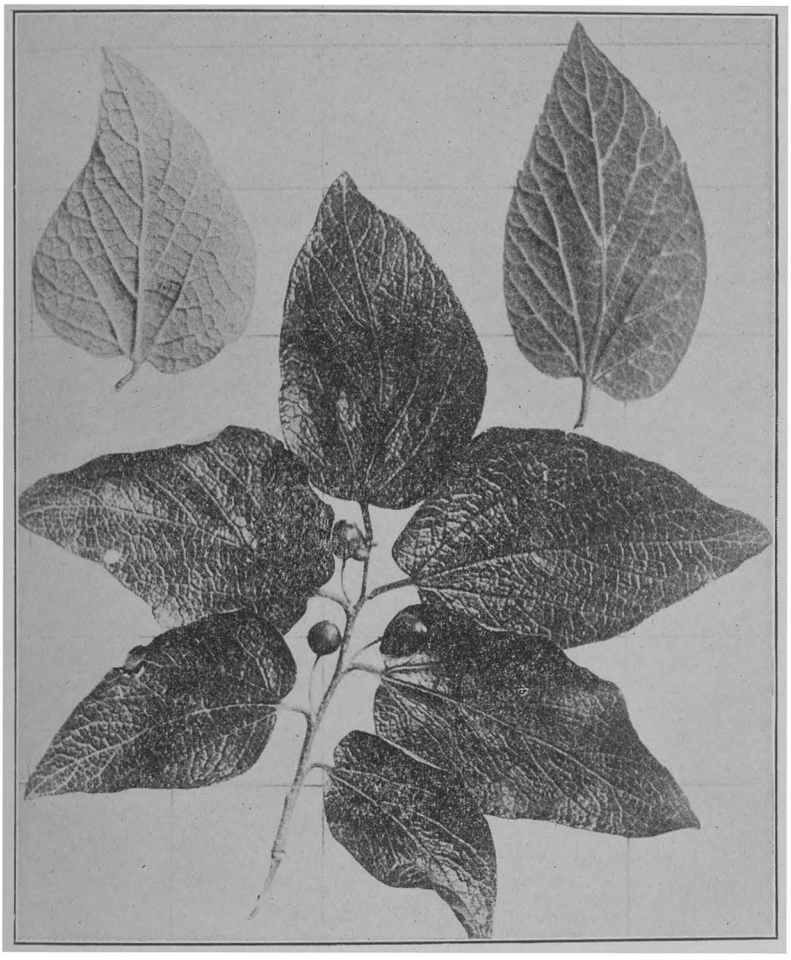


Fig. 30. Celtis reticulata.

2°-3°. The branches are widespread, forming a rounded crown. Bark on mature trunks is characterized by the numerous corky warts. The young twigs are slender and hairy, becoming smooth and brown with age. Leaves firm, ovate to

oblong or sometimes oblong-lanceolate, 1½′-4′ long, pointed or blunt at the apex, heart-shaped at base, dark green and rough above, hairy below, with rather prominent netted veining, toothed above the middle. Fruit globular, light, lustrous brown, borne on short curved stalks. Seeds globose with four prominent ribs.

Dry soil of southern Texas.

The wood is similar to Celtis Mississippiensis, from which it is not generally distinguished. The tree is used for street and ornamental planting.

3. Celtis reticulata Torrey. Thick Leaved Hackberry. A small bushy tree 40°50° high with rounded crown. Bark bluish gray and covered with numerous corky warts on the older parts of the stem. Leaves thick and very strongly netted veined, entire or toothed above the middle, dark green and smooth or somtimes rough above, paler and somewhat hairy beneath, with prominent reticulate veining. Fruit globular, red, ¼′ to ½′ long, borne on stalks which are usually longer than the subtending leaf petiole.

Kansas to Texas, Colorado, Nevada, Arizona, and Lower California. It is widely distributed in Texas.

Uses similar to Celtis Mississippiensis.

4. Celtis Mississippiensis Bose. Mississippi Hackberry A tree 60°-80° high and 2°-3° in diameter. The branches are somewhat pendulous and form a broad rounded crown. Bark light gray with corky warts, 1/2′-2/3′ thick. Leaves broadly ovate to ovate-lanceolate, long pointed somewhat curved, unequal at base, entire or with never more than one or two teeth, firm dark green and smooth above, paler below, 3′-4′ long, ¾′-3′ wide. Fruit ovoid-globose ⅛′-¼′ long, bright orange red, borne on a stalk which is somewhat elongated. The tree differs from other hackberries particularly in the size of the fruit and in the entire margined leaf. It is the commonest of our hackberry trees.

Indiana to Florida, and west to Missouri and Texas.

Used for fuel, fencing, and to some extent for flooring. The commonest street shade tree in central Texas.

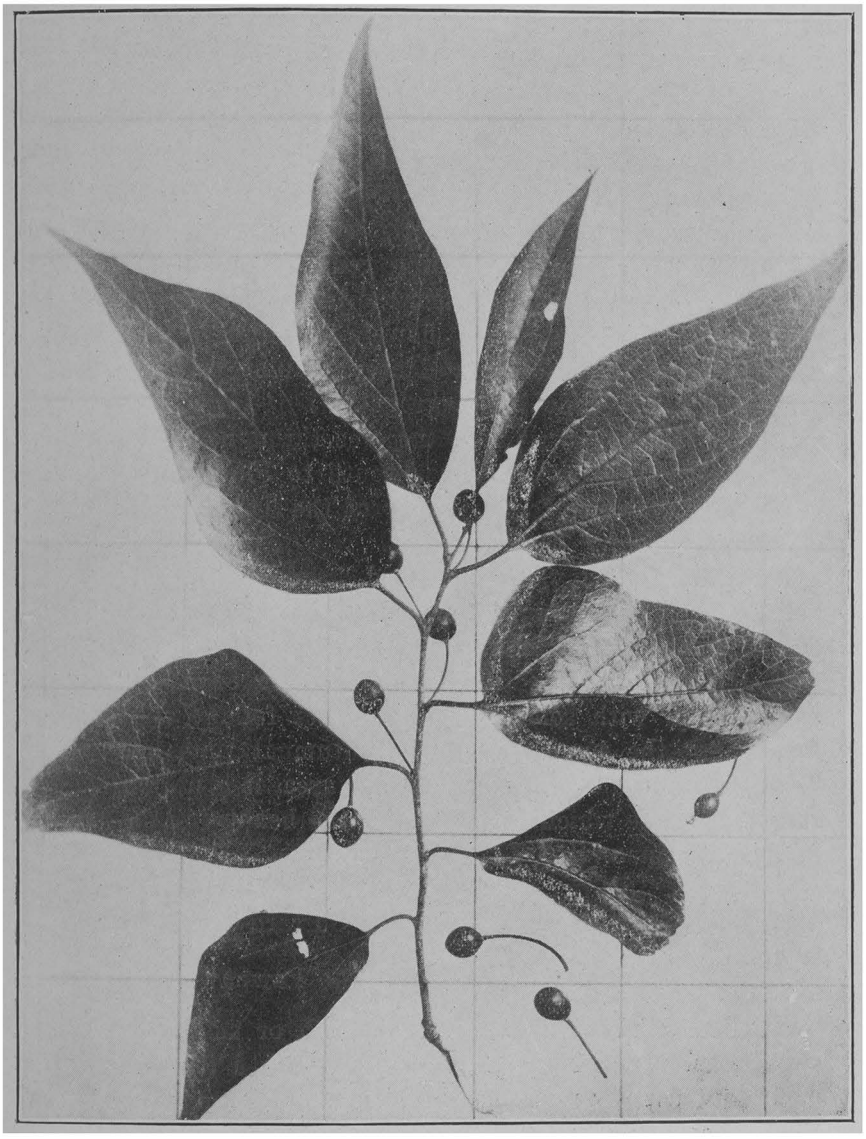


Fig. 31. Celtis Mississippiensis.

ALTINGIAECEAE Hayne. Sweet Gum Family.

Liquidambar.

Liquidambar styraciflua L. Sweet Gum. A tree 80°-140° high with straight erect trunk 4°-5° in diameter. The branches

are slender and form a rather narrow crown. Bark deeply furrowed, gray to brown, ¾′-1½′ thick. The young branches are frequently winged with cork. A resinous sap which issues from wounds is popular among children as "gum." Leaves alternate, almost round in outline, about 5′ wide, cleft into 4-7 wedge-shaped, serrate lobes, firm, bright green, and shining above, paler below, aromatic when bruised, smooth on both sides or nearly so, turning red in the autumn before they fall. Flowers appear when the leaves are about half the adult size. The staminate flowers are borne in slender racemes, the pistillate in a dense globular head. Fruit a globular, spiny, cone-like aggregate, 1¼′-1½′ in diameter, which frequently persists on the tree throughout the winter.

Connecticut west to Missouri, south to Florida and Texas. In Texas it extends to the valley of the Trinity River, most abundant in heavy bottom soils.

The wood is heavy, close-grained, hard but not strong. It polishes well and can be finished to imitate walnut. However, it warps and shrinks to such an extent that it is but little used for timber. The tree is planted for ornament but is transplanted with some difficulty. Its foliage is beautiful throughout the summer and the autumnal tints add to its value as an ornamental tree. In our area, it is attacked by a fungus parasite which tends to mar the beauty of the foliage in the late summer.

ANONACEAE de Condolle. The Custard Apple Family.

Asimina (L) Dunal. The Pawpaw.

Asimina triloba Dunal. A tall shrub or small tree sometimes reaching a height of 25° or 30° with a trunk diameter of 1°, but usually much smaller, with slender nodding twigs. Bark smooth, somewhat ridged on old trees, about ⅛′ thick, gray or brown with lighter blotches except on young twigs, where it is reddish brown. Leaves obovate-lanceolate, wedge-shaped at base, sharp pointed at the apex, 4′-12′ long, 4′-6′ wide, green above, paler and hairy beneath when young, becoming smooth with age. The leaves give off a rank foetid odor when crushed. The flowers appear before or with the

leaves. The sepals are green, broadly ovate; the six petals are green at first but soon become maroon color. Fruit cylindrical, somewhat curved, about 2½′-5′ long, green becoming yellow, finally brown. The flesh is sweet and edible and the fruit has been recently called the "Hoosier banana."

Southern Ontario, east to Pennsylvania, south to the Gulf States and west to Kansas and Texas. In Texas it extends to the valley of the Sabine River.

The wood is soft, light, and coarse grained. The supply is so small that it has no economic importance for timber. The fruit is edible and the tree is adapted for ornamental planting within its native range. It prefers deep rich moist soil.

MAGNOLIACEAE St. Hilaire. The Magnolia Family.

Trees with alternate simple, entire, large leaves and bitter, aromatic bark. The flowers are large, perfect, solitary, terminal. The fruit is a cone-like aggregate.

Leaf blades thick, leathery, persistent, with brown, rusty hairs beneath..... M. foetida.
Leaf blades membranous, smooth or silky beneath.. M. Virginiana.

1. **Magnolia foetida** (L.) Sargent. Bull Bay. Laurel. A large cone-shaped tree 60°-80° high and 4°-5° in diameter, with short branches, and rough, light brown, scaly bark ½′-¾′ thick. Leaves evergreen, firm, leathery, bright glossy green above, duller and covered beneath with rusty hairs, 5′-8′ long, 2′-3′ wide with prominent ribs and veins. Fruit ovate or oval 3′-4′ long, 1½′-2½′ wide, flattened somewhat and covered with hair.

In river swamps and near ponds. North Carolina, south to Florida and westward to Arkansas and Texas. In Texas it extends to the Brazos valley.

The wood is rather hard and used to a very limited extent only for timber. The tree is planted for ornamanet and is highly prized throughout its range.

2. **Magnolia Virginiana** L. Sweet Bay. White Bay. Swamp Bay. A slender tree reaching a maximum height of 50°-70° with trunk diameter of 2° to 3½°, but usually small-

er, the base of the trunk is frequently swollen. Bark thin and gray on mature trunks, pale gray or almost white on younger branches. The twigs are covered with fine hairs. Leaves oblong to elliptic, firm, evergreen, green and shining above, pale and with fine silky hairs below, 4′-6′ long, ½′-2½′ wide, with prominent veins and midrib. Flowers globular, white and fragrant. Fruit oval, smooth, dark red, 2′ long, ½′ wide, with flattened seeds.

Massachusetts, Pennsylvania, south to Florida and west to Arkansas and Texas. In Texas it extends to the Trinity Valley.

The wood is rather light and is not extensively used for timber. The tree is planted for ornament throughout its range and is well adapted for this purpose.

PLATANACEAE Lindley. The Plane Tree Family.

Platanus. The Plane Tree.

Platanus occidentalis L. Sycamore. Button Wood. A very large tree 140°-170° high with a trunk diameter sometimes reaching 10°-11°. The trunk frequently branches near the ground into several large secondary divisions forming a very wide spread, irregular, open crown. Bark on old trunks is gray to reddish brown with plate-like scales, on younger portions it is grayish green, thin, separating from the tree in large, thin brittle plates which exposes the whitish smooth inner layer, giving the tree a clean "whitewashed" appearance. Leaves broadly ovate, 3-5 lobed, 4′-9′ wide, the lobes broad, toothed, thin and firm, bright green above, paler below, hairy when first expanded, becoming smooth with age. Flowers borne in dense globular heads on wooly stalks appearing with the leaves. Fruit a globular head ½′-1½′ in diameter which bears numerous seeds, and persists on the tree until the following spring. The seeds drop out throughout the early winter.

Southern Ontario, Maine, south to the Gulf States and west to Nebraska and Texas. In Texas it extends to the valley of the Devils River. It grows principally along streams and in

rich lowlands, but is extensively planted in Texas as an ornamental shade tree on dry uplands, where it thrives very well.

The wood is heavy, hard, close-grained, but weak, takes a high polish and is used to some extent for interior finishing. The tree is not regarded in the northern states as desirable for ornamental planting as the leaves are attacked by a fungus which causes them to fall prematurely. In our area, however, the defoliation does not appear to be so severe from this cause and it has been extensively used as a street shade tree. It is undoubtedly superior to some trees which are more abundantly grown.

MALACEAE Small. The Apple Family.

Trees with simple alternate leaves, regular perfect flowers, and more or less fleshy, pomaceous fruits.

Mature fruit green in color with mature carpels papery ..... 1. Malus.
Mature fruit red, orange, blue, black, yellow with mature carpels bony..... 2. Crataegus.

MALUS. The Apples.

Malus Soulardii (Bailey) Britton. Crab Apple. A small, upright, stout tree reaching a height of 15°-25° and a trunk diameter of 6′-8′, with rather stiff and dense rounded crown. Bark reddish brown, fissured, and scaly, rather thin. Leaves ovate, elliptic or obovate, blunt at the apex with rounded narrow base, irregularly toothed or sometimes lobed, very wooly at first but becoming smooth above, remaining hairy beneath. Flowers rather large, about 1½′-2′ in diameter when fully expanded, rose pink, in dense flat topped clusters. Fruit flattened, globose about 1⅛′ long and 1½′ in diameter, greenish yellow when mature, the flesh is firm and is acid to the taste.

Minnesota southward to Texas. It occurs but sparingly in the woods of east Texas.

The tree is valuable for ornamental planting.

CRATAEGUS. The Thorn Trees. Hawthorn.

Small trees or shrubs, usually spiny; leaves simple, alternate, toothed, notched or lobed; flowers mostly white; fruit fleshy,

variously colored. This genus comprises more species than any other, some 600 having already been described.

1. Leaves 6-7 lobed, the margins of the lobes sharply serrate..... 1. C. Apiifolia
2. Leaves variously notched, toothed or serrate, sometimes 3 lobed at the apex.
   a. Leaves broadest above the middle.
      (1) Leaves entire at base, serrate above the middle, some of them 3 lobed at the apex; fruit scarlet..... 2. C. spathulata.
      (2) Leaves entire at base, serrate toward the apex; fruit green tinged with red.. 3. C. edita.
      (3) Leaves entire at base, serrate above the middle, not lobed; fruit blue or blue black ..... 4. C. brachycantha.
      (4) Leaves oval to obovate; fruit longer than broad, bright canary yellow, 1/3'-½' long..... 5. C. Brazoria.
      (5) Leaves elliptical toothed or serrate above the middle; fruit bright red dotted with pale spots, ripening in May 6. C. aestivales.
      (6) Leaves ovate to oblong ovate, sometimes 3-lobed toward the apex; fruit scarlet or orange, ripening in the autumn, ⅛'-¼' in diameter..... 7. C. viridis.
      (7) Leaves oblong ovate to semiorbicular, serrate above the middle; fruit dull orange, about ¼' in diameter..... 8. C. glabriscula.
   b. Leaves broadest at the base..... 9. C. Texana.

1. Crataegus apiifolia Michx. Parsley Haw. A small tree sometimes 20° high with a trunk diameter which may reach 6'-8' but is usually smaller. The branches spread at right angles, forming a rather broad irregular crown. Branchlets armed with stout, straight, chestnut-brown spines which are 1'-1½' long. Bark smooth and rather thin, gray in color. Leaves broadly ovate to orbicular, somewhat heart-shaped at the broad base, 5-7 lobed, the lobes sharply serrate 1'-1½' long 2/3'-1½' broad, bright green above, pale below. Flowers ½' in diameter borne in 10-12 flowered corymbs, stamens 20 anthers bright rose red. Fruit oblong to oval ⅓ long, scarlet, with 1-3 nutlets, often hanging on the tree until early winter.

Southern Virginia to Florida and west to Arkansas and Texas. In Texas it extends to the Trinity Valley.

2. Crataegus spathulata Michx. Small-fruited Thorn. A small tree 18°-25° high and trunk diameter of 8′-10′ with upright, spreading branches which form a rather wide, rounded crown. The branchlets are smooth or armed with straight, brown spines 1′-1½′ long. Bark gray or brown, smooth or somewhat scaly. Leaves shaped like a spathula, rounded and sometimes 3-lobed at the apex, serrate except at the base, dark

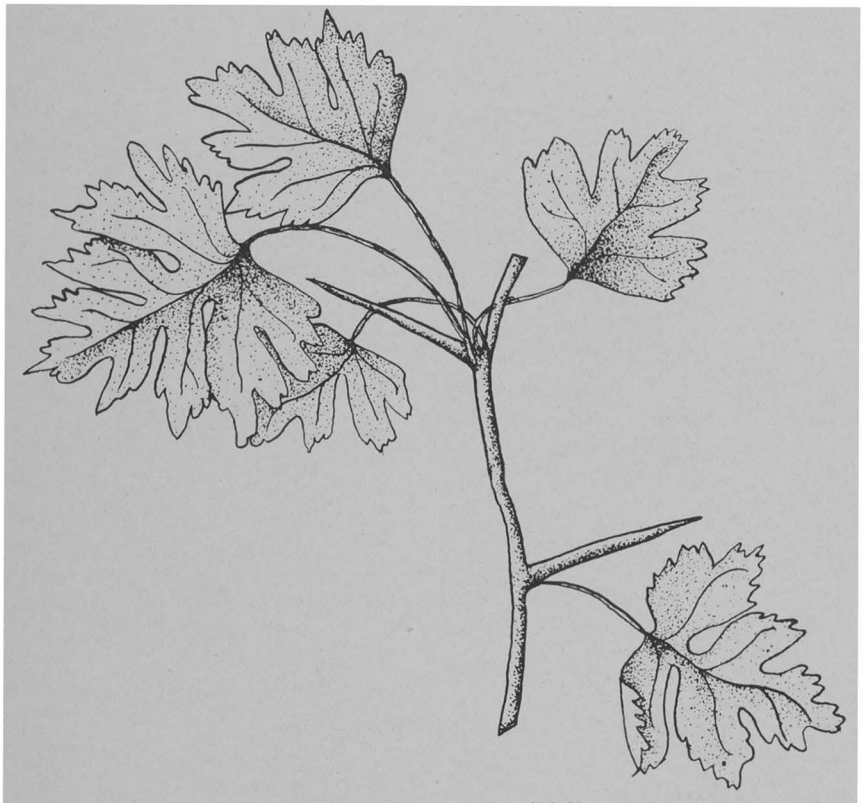


Fig. 32. Crataegus apiifolia.

green above, paler below, 1′-2′ long, 1′-1½′ wide. Flowers ½′ in diameter on slender pedicels in many flowered corymbs; calyx lobes triangular, stamens about 20, anthers rose colored. Fruit ripening in autumn, globose to sub-globose ⅛′ in diameter, bright scarlet with 3-5 nutlets and thin, dry mealy flesh.

Virginia to Florida and west to Arkansas and Texas. In Texas it extends to the valley of the Colorado River. It occurs abundantly in the eastern portion of the state.

3. Crataegus edita Sargent. A tree sometimes reaching a height of 40° and trunk diameter of 1°, but usually smaller. The branches are stout, horizontal and form a wide, rounded crown. The branchlets are armed with scattred, brown spines which become gray with age. Bark dark, rather thin and scaly. Leave oblong, obovate or oval, 1½′-2′ long, ½′-1′ wide, smooth and dark, lustrous green above, paler and somewhat pubescent along the veins below, serrate above the

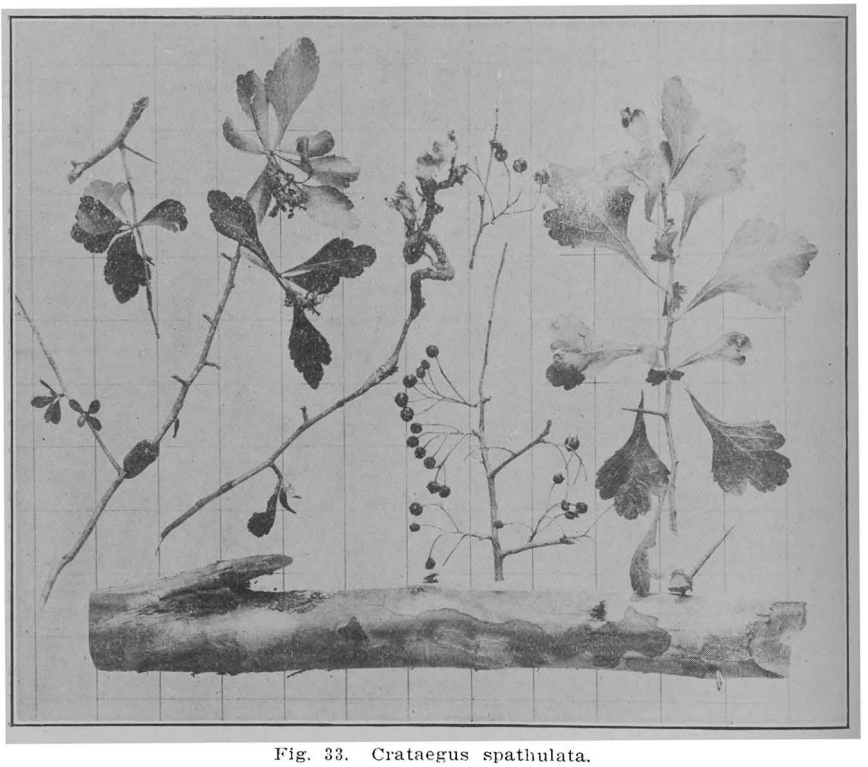


Fig. 33. Crataegus spathulata.

middle, entire and wedge-shaped at base. Flowers are ½′-2/3′ in diameter, in few flowered corymbs; sepals entire or somewhat serrate, stamens 20, anthers rose red. Fruit ripens in autumn, short oblong ¼′-⅓′ long, dull green, tinged with red, with thin, greenish flesh.

In low wet woods and stream borders in the valley of the Sabine River.

4. Crataegus brachycantha Sarg. and Engelm. A tree 18°-25° high with trunk diameter of 8′-10′, branches upright, spreading to form a rather broad rounded crown; branchlets armed with straight light brown spines 1′-1½′ long. Bark dark brown and rather deeply fissured on mature trunks, light brown on younger twigs. Leaves lanceolate-oblong to ovate, serrate above the middle, 1′-2′ long ½′-1′ wide, dark green above, paler beneath. Flowers in many flowered corymbs. Fruit ripening in August, bright blue, ⅓′-½′ in diameter.

Northwestern Louisiana to eastern Texas.

5. Crataegus Brazoria Sargent. A small round topped tree 20°-25° high with ascending branches, gray scaly bark, and long gray spines. Leaves oval to obovate, wedge-shaped and entire at base, rounded or pointed at apex, serrate, smooth, lustrous green aboce, 2′-2½′ long, 1¼′-1½′ wide, pale beneath with a few hairs. Flowers in many flowered corymbs, the pedicels and calyx hairy. Fruit ripening in autumn, subglobose, bright canary yellow.

In rich woods and bottom lands along the Brazos River.

6. Crataegus aestivalis. A medium sized tree 20°-30° high and 12′-18′ in diameter with straight or divided trunk, reddish, armed twigs and scaly, reddish brown bark. Leaves elliptical, oblong or obovate, 1½′-2′ long, ½′-1′ wide, entire at base, notched or toothed above the middle, smooth above, with rusty hairs along the veins and midrib below. Corymb 2-5 flowered. Fruit ripening in May, depressed globose, 1/2′-2/3′ in diameter, bright red with pale spots, and thick, juicy flesh.

Florida to Arkansas, Louisiana and eastern Texas.

7. Crataegus viridis L. Southern Thorn. A small round topped tree 20°-30° high and 18′-20′ in diamter with orange colored bark, gray to reddish brown twigs and slender short spines. Leaves oblong-obovate, pointed or rounded at the apex, wedge-shaped and entire at base, serrate above with glandular teeth or some of them 3-lobed toward the apex, 1′-3′ long, ½′-1½′ wide, smooth above with hairs in the axils of veins below. Corymbs smooth, many flowered. Fruit ripen-

ing in the autumn, remaining throughout the winter, depressed globose, ⅛′-¼′ in diameter, bright scarlet with thin dry flesh.

Maryland, South Carolina to Florida and west to Missouri and Texas. It extends to the Colorado River.

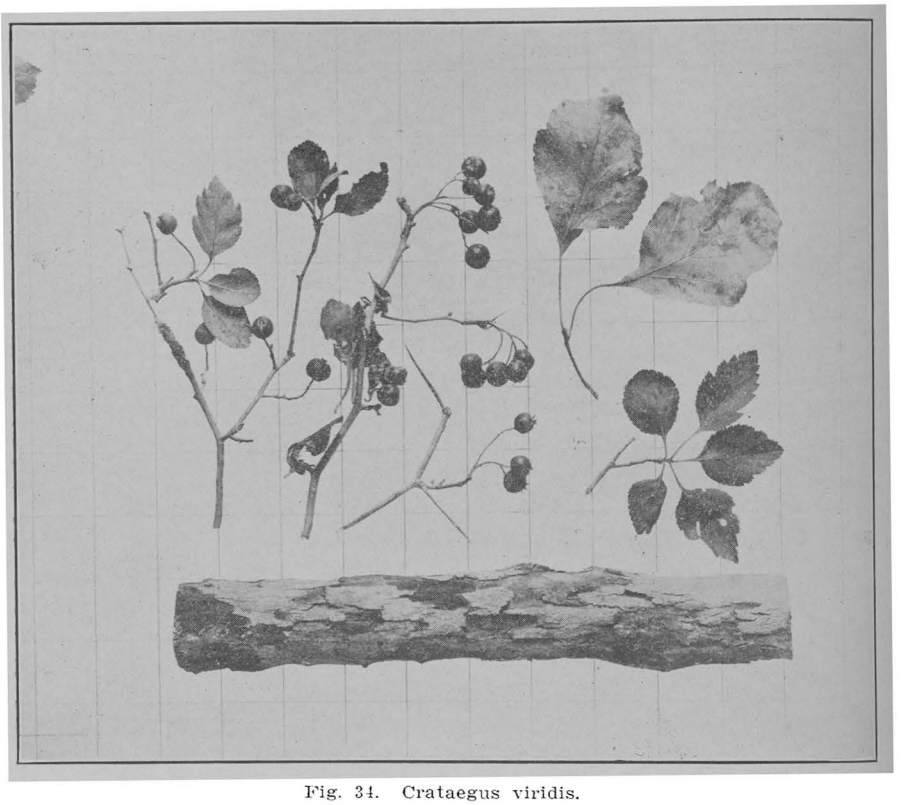


Fig. 34. Crataegus viridis.

8. Crataegus glabriscula Sarg. A medium sized tree 20°-25° high with ascending branches, brown, scaly bark and slender, brown spines. Leaves oblong, ovate or somewhat orbicular, pointed or rounded at the apex, 1½′-2′ long, ¾′-1′ wide, entire at base, glandular, toothed above the middle, sometimes 2-3 lobed toward the apex. Corymbs few flowered, smooth; pedicels long and slender. Fruit ripening in the autumn and remaining on the tree throughout early win-

ter, obovate to globose, about ¼′ long, dull orange with small dots.

In the bottom lands of the Trinity River.

9. Crataegus Texana Buckley. Texas Thorn. A medium sized round topped tree 25°-30° high with scaly bark, reddish brown twigs and chestnut colored spines. Leaves broadly ovate, pointed at the apex, doubly serrate, frequently 4-5 lobed above the middle, 3′-4′ long, 2½′-3′ wide, smooth above, hairy below. Corymbs many flowered, hairy, the flowers large. Fruit ripening in the autumn, pear-shaped when young, becoming short oblong at maturity, ¾′-1′ long, bright scarlet, with pale dots. In bottom lands, central and west Texas.

AMYGDOLACEAE Reichenbach. The Plum Family.

Trees or shrubs with alternate simple serrate leaves which are firm or leathery and sometimes persistent until the following season. Flowers regular, perfect, petals 5, sepals 5, stamens numerous. Fruit a one seeded edible drupe.

Drupes fleshy.
- Flowers umbellate to corymbose, borne before the leaves on branchlets of the previous season ..... 1. Prunus.
- Flowers racemose, borne on branchlets of the year after the leaves..... 2. Padus.

Drupes dry or nearly so, leaves persistent..... 3. Laurocerasus.

PRUNUS (Tournefort) L. Plums and Cherries.

Drupe purple, red, yellow or orange, with a bloom.. P. tarda.
Drupe red or orange without bloom.
- Leaves oblong to obovate, petioles not glandular.. P. Americana.
- Leaves ovate-lanceolate to lanceolate, petioles glandular ..... P. hortulana.

1. Prunus tarda Sargent. Texan Sloe. A small tree 20°-25° high with spreading branches, thin, scaly bark, and lustrous branchlets which become dull with age. Leaves oblong to obovate 1½′-3′ long, ¾′-1¼′ wide, pointed, firm, serrate, yellowish green and smooth above, somewhat hairy along the midrib and prominent veins below. Flowers in clusters of

2 or 3. Fruit variously colored, oblong to subglobose, sour, with flattened wrinkled stone.

Arkansas, Louisiana and Texas.

2. Prunus Americana Marsh. A medium sized, broad topped spiny tree 25°-30° high with drooping branches, green twigs and reddish brown branchlets. Leaves oval to obovate, pointed at the apex, 3′-4′ long, 1½′ wide, sharply serrate with incurved teeth, smooth and yellow to dark green above, paler and somewhat hairy beneath. Flowers white in clusters of 2-5. Fruit globular to oblong, 1′ or less long, red, with juicy, acid flesh.

New York west to Montana, south to Florida and west to Texas. Cultivated for fruit and ornament throughout its range.

3. Prunus hortulana Bailey. Wild Plum. A small low branched, broad topped tree 20°-25° high with thin dark brown bark and reddish brown twigs. Leaves ovate-lanceolate or oval, 4′-6′ long, 1′-1½′ wide, firm, long pointed at the apex, serrate with incurved glandular teeth, smooth, dark green above, paler and with hairs in the axils of primary vein beneath. Flowers in 2-4 flowered lateral clusters before the leaves. Fruit globular to subglobose or oval, ¾′-1′ in diameter, red, with thin, hard, acid flesh.

In rich moist soil. Illinois to Tennessee, Alabama, Arkansas and Texas.

PADUS Borkhausen. Wild Cherries.

Sepals not present on fruit, leaves with slender teeth ..... 1. P. Virginiana.
Sepals present on fruit, leaves with coarse teeth.
  Sepals broader than long, leaves with reticulate veins ..... 2. P. eximia.
  Sepals longer than broad, leaves not reticulate veined ..... 3. P. serotina.

1. Padus Virginiana (L.) Roemer. Choke Cherry. A shrub or small tree 20°-25° high with spreading, drooping branches, thin, smooth, dark gray bark and reddish brown twigs. Leaves ovate to obovate, 2′-4′ long, 1′-2′ wide, thin,

pointed at the apex, serrate with slender teeth, smooth on both sides. Flowers in loose racemes. Fruit globose, ¼′-½′ in diameter, red, black, or yellow with thin, juicy, astringent flesh.

Newfoundland to Manitoba and British Columbia, south to Georgia, west to Texas and Colorado.

2. Padus eximia Small. Texas Cherry. A rather large round topped tree 60°-80° high with spreading branches and smooth, red-brown twigs. Leaves ovate, some of them varyng to oblong, oblong-lanceolate or oval, 1½′-3′ long, blunt at the apex or taper pointed, serrate, smooth on both sides, dark green above, paler beneath. Flowers in drooping racemes. Fruit globose, purple, with sweet flesh.

Found only in rich valleys of southern Texas.

3. Padus serotina (Ehrh.)Agardh. Wild Cherry. Black Cherry. A large narrow topped tree 80°-100° high and 4°-5° in diameter, with horizontal branches, and reddish brown, rough, aromatic, bitter bark and twigs. Leaves oblong, or elliptic to obovate lanceolate, 2′-5′ long, 1½′-2′ wide, taper pointed, finely serrate with incurved teeth, firm, glossy, smooth on both sides. Flowers white in long racemes. Fruit globose, almost black with sweet, astringent flesh.

Ontario to North Dakota, Florida and Texas. In Texas it is found in the eastern portion and in the mountains of the west.

The wood is strong, hard, close grained, yellowish red, and is used in making furniture, panels and for finishing.

LAUROCERASUS (Tournefort) Reichenbach. Wild Orange. Wild Peach.

Laurocerasus caroliniana (Miller) Roemer. A beautiful, medium sized tree 30°-40° high with smooth, gray bark, green twigs and reddish brown branches. Leaves leathery, persistent, elliptic, oblong-lanceolate, entire or few teeth, 2′-4′ long, pointed at the apex, glossy green above, dull below. Flowers in short racemes. Fruit oblong or oval, black with thick, lustrous skin and thin flesh.

North Carolina to Florida and Texas. Planted throughout its range as an ornamental tree.

MIMOSACEAE. The Mimosa Family.

Trees with alternate compound evenly pinnate leaves and small leaflets. Fruit a bean-like pod.

Leaves with 1 to 2 pairs of pinnae.
  Leaflets 5 to 8 pairs, pods tightly twisted..... 1. Strombocarpa.
  Leaflets 12-20 pairs, pods not twisted..... 2. Prosopis.
Leaves 2 to 3 pairs of pinnae, leaflets numerous.. 3. Siderocarpus.
Leaves with 1 to 4, 2 to 3 or 3 to 4 pairs of pinnae. 4. Acacia.
Leaves with 3 to 5 pairs of pinnae..... 5. Havardia.
Leaves with 3 to 8 pairs of pinnae..... 6. Vachellia.
Leaves with 2 to 20 pairs of pinnae..... 7. Leucaena.

1. STROMBOCARPA. Screw Bean.

1. **Strombocarpa odorato** (Torrey) A. Gray. Screw Bean. A shrub or small tree with thick, shaggy, light brown bark, and reddish brown branches which are armed with axillary spines. Leaves bipinnate mostly with 1 pair of pinnae, sometimes 2 pairs. Flowers in slender, stalked, axillary spikes. Fruit a twisted cylindrical pod.

2. PROSOPIS. The Mesquites.

1. **Prosopis glandulosa** Torrey. Mesquite. A low, round topped tree with thick, reddish brown, fissured bark, yellowish green twigs and darker branches which are frequently armed with axillary spines. The leaves are bipinnate with 1 to 2 pairs of pinnae; leaflets numerous. Flowers perfect, borne in slender, green or yellowish spikes. Fruit a straight or slightly curved indehiscent pod.

Mexico north to Nevada, Kansas, Texas and California. It has gradually encroached on the grassy plains and frequently forms dense shrubbery thickets.

The wood is heavy, very hard, close grained, dark red in color, very resistant in contact with the soil, takes a beautiful finish. It is used for furniture, ornaments, gun stocks, grill work, posts and fuel. The beans are used for food.

3. SIDEROCARPAS. Texas Ebony.

1. Siderocarpas flexicaulis (Bentham) Small. A small evergreen tree or shrub with spreading zigzag branches, armed with short spines. Leaves bipinnate, pinnae 4-6, leaflets few,

Fig. 35. Prosopis glandulosa.

sessil, leathery. Flowers in summer or autumn, in cylindrical shaped spikes. Fruit a flattened, straight, or slightly curved pod. On bluffs of southwest Texas and Mexico.

The wood is dark red to purplish brown, hard, used for cabinet work.

4. **ACACIA** (Tournefort) Adamson. The Acacias.

Thorny trees with alternate evenly bipinnate leaves, numerous pinnae and numerous leaflets. Flowers in globose heads, or cylindrical racemes. Fruit an elongated, flat or cylindrical pod.

Flowers in elongated spikes or racemes.
Pods only slightly curved..... 1. A. Wrightii.
Pods much curled and contorted..... 2. A. Greggii.
Flowers in globular heads..... 3. A. Subtortuosa.

1. Acacia Wrightii Bentham. Cat's Claw. A small wide topped tree, sometimes 25° high, with furrowed bark; striated, angular branchlets, and short curved spines. Leaves evenly bipinnate with 2-6 pinnae; leaflets 6-12, sessil, firm, light green, hairy, with prominent veins. Flowers borne in racemes in the axils of the leaves, yellowish, fragrant. Fruit a flattened, almost straight pod constricted between the seeds. Western Texas to Mexico.

The wood is close grained, hard, used for fuel.

2. Acacia Greggii A. Gray. Paradise Flower. Devil's Claw. A small, thorny tree 20°-30° high with stout reddish brown zigzag branchlets and hairy twigs. Leaves evenly bipinnate, pinnae 2-6, leaflets 8-14, thick, firm, light green. Fruit a very much contorted flattened pod constricted between the seeds. In the ravines from the valley of the San Saba River to the Devil's River and south to Mexico.

3. Acacia subtortuosa Shafer. Rio Grande Acacia. A small round topped tree 18°-20° high or a shrub, with dark brown fissured bark, zigzag branches, hairy twigs and light gray spines. Leaves evenly bipinnate, pinnae 6-8, leaflets 9-14 pairs. Flowers in globose heads, in axillary clusters of 1-3, fragrant, bright yellow. Fruit a straight slightly flattened pod, somewhat constricted between the seeds. Along the Rio Grande River, southwestern Texas and adjacent Mexico.

5. **HARVARDI** Small. Huajillo.

1. **Havardia brevifolia** (Benth). Small. A small, evergreen tree with erect branches, thin gray bark and short curved

spines. Leaves evenly bipinnate, pinnae 2-5 pairs, each with 10-20 pairs of sessile light green leaflets. Flowers in head-like clusters. Fruit a flattened, pointed, dehiscent pod. Along the Rio Grande River and Northern Mexico.

The wood is hard, dark reddish brown and very heavy.

6. VACHELLIA Wright and Arnott. Huisache.

1. Vachellia Farnesia (Linnaeus) Arnott and Wright. A small, round-topped, thorny tree 20°-30° high, with drooping branches and thin bark which peels off in long, reddish brown scales. Leaves evenly bipinnate, pinnae 3-8 pairs, leaflets 20 to 50, light green and smooth on both sides. Flowers yellow in globular heads, very fragant. Fruit a cylindrical, straight or slightly curved, dark brown or purplish pod constricted between the seeds.

On the plains and prairies of Southern Texas and South to Mexico. Extensively cultivated throughout the tropics.

7. LEUCAENA Benth. Lead Trees. Trees or shrubs with evenly bipinnate persistent leaves, slender branches without thorns, flowers in globose heads, and dehiscent, linear, flattened pods.

Pinnae 10 to 20 pairs, twigs wooly..... 1. L. pulverulenta.
Pinnae 2 to 10 pairs, twigs smooth.
Leaflets 10-20 pairs..... 2. L. glauca.
Leaflets 16-30 pairs..... 3. L. Greggii.

1. Leucaena pulverulenta (Schlechtendal) Bentham. Mexican Lead Tree. A medium sized, round topped tree 40°-50° high with straight trunk, spreading branches and thick light brown scaly bark. Leaves evenly bipinnate, pinnae 10-20 pairs; leaflets 15-30 pairs, small, light green, smooth. Flowers in dense globose heads in the axils of the leaves. Fruit a brown, shining, linear flattened pod.

Along the Rio Grande River, Texas, and Mexico.

2. Leucaena glauca (Linnaeus) Bentham. Lead Tree. A shrub or small tree with spreading branches, thin, dark brown bark and hairy twigs. Leaves evenly bipinnate, pinnae 3-10 pairs, leaflets 20-40, light green, paler beneath. Flowers in

globose heads, solitary or clustered in the axils of the leaves. Fruit a linear flattened pod pointed at both ends.

In sandy and rocky soils Florida to Texas and Mexico.

CASSIACEAE Link. Senna Family.

Trees or shrubs with alternate, simple or compound leaves; some species armed with prickles. Flowers mostly perfect, in clusters, regular or irregular. Fruit a 2-valved or indehiscent pod.

1. Leaves simple, rhomboidal, heart shaped at base ..... 1. Cercis.
2. Leaves pinnate.
   a. Leaves once pinnate.
      (1) The axis of the pinnae broad and winged, borne in fasicles, leaflets numerous ..... 2. Parkinsonia.
      (2) The axis of the pinnae not broad and winged, leaflets few ..... 3. Cercidium.
3. Leaves bipinnate or once pinnate on the same tree ..... 4. Gleditsia.

CERCIS L. The Red Buds.

Small unarmed tree with alternate, simple, deciduous leaves which are round in outline and heart-shaped at base. Flowers red or purplish in axillary clusters on branches of preceding year, appearing before the leaves. Fruit a flattened, leathery pod.

Leaves pointed at the apex, pods stalked ..... 1. C. Canadensis.
Leaves rounded and blunt at the apex.
Pod not stalked ..... 2. C. reniformis.

1. Cercis Canadensis R. Red Bud. Judas Tree. A small tree with thin fissured bark, smooth branches, and slender, light brown twigs. Leaves ovate-orbicular to reniform, pointed at the apex, rounded at base, bright green and smooth above, paler and hairy along the veins below. Flowers before the leaves in clusters of 4 to 8, purplish, pedicels somewhat elongated. Fruit a linear oblong pod which tapers at both ends, persistent until winter.

Ontario to Florida, west to Minnesota, Arkansas, and eastern Texas. Principally along streams and in rich bottom

lands. A very desirable ornamental tree or shrub which should be more extensively cultivated.

2. Cercis reniformis Eng. Red Bud. A tree resembling

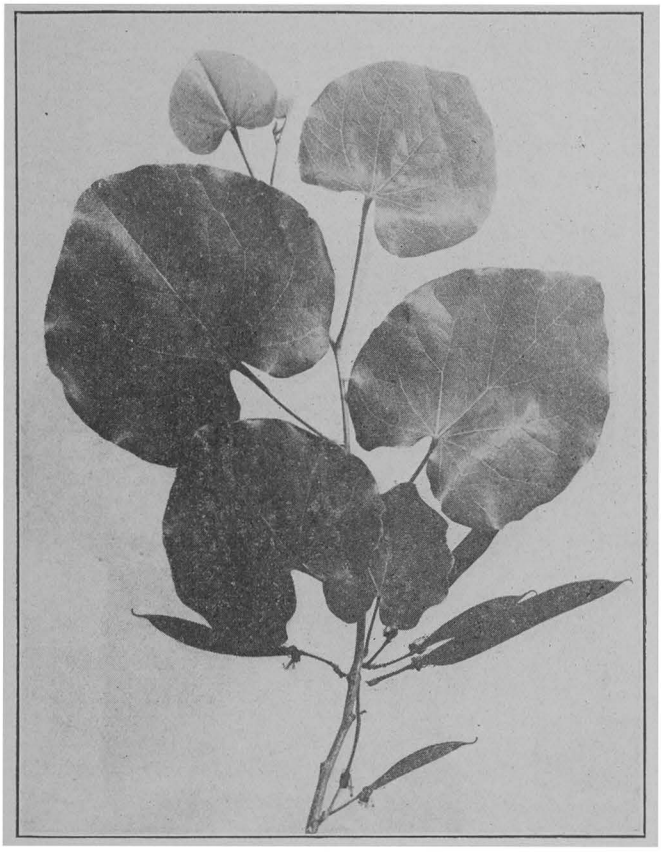


Fig. 36. Cercis reinformis.

Cercis canadensis, but with blunt pointed leaves and dense flower clusters.

Texas and Mexico.

PARKINSONIA (Plumies) L. The Horsebeans.

1. Parkinsonia aculeata L. Retama. A small thorny, open topped tree or shrub, with thin, reddish brown, mostly smooth bark and yellowish green twigs. Leaves in fasicles,

bipinnate, rachis winged, leaflets numerous, small, rather far apart. Flowers large and showy, bright yellow, in slender upright racemes. Fruit a cylindrical few seeded pod, contracted between the seeds, pointed at base and apex. In the Rio Grande Valley and extending into Mexico. It has been extensively naturalized throughout the southern part of Texas and is planted for ornament.

CERCIDIUM Tulasne.

1. Cercidium floridum Benth. A low wide topped tree 15°-20° high with short, crooked trunk, green bark and axillary spines. Leaves evenly bipinnate, pinnae 1 pair bearing 2-4 pairs of small glandular leaflets. Flowers appearing with the leaves and produced for several months in successive crops, rather large, golden yellow, in 3 to 5 flowered racemes. Fruit a flat, straight, dehiscent, 2 to 3 seeded pod, constricted between the seeds.

Southern Texas and adjacent Mexico.

The wood is soft, close grained, used for fuel.

GLEDITSIA (Clayton) L. The Honey Locusts.

Trees with alternate, equally bipinnate or once pinnate leaves; small, greenish, polygamous flowers in slender axillary clusters; simple or branched axillary spines, and elongated or oval pods.

Pod oval or elliptic with 1 or 2 seeds..... 1. G. aquatica.
Pod elongated 8 to 12 inches, many seeded..... 2. G. triacanthos.
Pod elongated 4 to 5 inches, many seeded..... 3. G. Texana.

1. Gleditsia aquatica Marsh. Water Honey Locust. A medium sized, wide topped tree 50°-60° high with short trunk, stout branches, reddish brown, fissured bark and straight spines which are usually only slightly branched. Leaves once or twice pinnate, pinnae 3 or 4 pairs, leaflets 3 to 12 pairs. Flowers 1′ long, ⅓′-½′ wide, in slender racemes after the leaves. Fruit an obliquely oval 1 or 2 seeded pod.

In swampy places North Carolina, Florida west to Indiana, Arkansas and Texas. The wood is heavy, hard and strong. Tree sometimes planted for ornament.

2. Gleditsia triacanthos L. Honey Locust. A rather large rapidly growing tree 100° or more high with pale rough bark, spreading branches, zigzag twigs and long simple or branched thorns. Leaves mostly bipinnate sometimes once pinnate. Flowers in staminate and pistillate racemes in April. Fruit a long, flattened, more or less twisted pod with a pulp between the seeds.

Ontario to Kansas, Florida and Texas. Extensively planted throughout. Grows well in dry or sandy soil. The thorns are somewhat objectionable. Wood hard, strong, coarse grained, reddish brown.

3. Gleditsia Texana Sargeant. Texan Honey Locust. A large narrow topped tree 100°-120° high, with thin, smooth bark and unarmed branches. Leaves once or twice pinnate. Flowers in axillary staminate and pistillate racemes. Fruit a straight, flat pod 4 to 5 inches long without pulp between the seeds. Reported from a single bottom land grove near Brazoria, Texas.

FABACEAE Reichenbach. The Pea Family.

Trees or shrubs with alternate, pinnate leaves, usually perfect pea shaped flowers, borne solitary or in compound clusters. Fruit a dehiscent or indehiscent pod.

Leaves with an odd leaflet at the end..... 1. Eysenhardtia.
Leaves without an odd leaflet at the end.
  Pods constricted between the seeds..... 2. Sophora.
  Pods not constricted between the seeds.
    Branches with thorns, pods winged on the margin ..... 3. Robinia.
    Branches without thorns, pods not winged 4. Coursetia.

EYSENHARDTIA H. B. K.

1. Eysenhardtia orthocarpa S. Watson. A small tree or shrub with thin, gray, scaly bark and reddish brown twigs. Leaves equally pinnate, leaflets 10-24 pairs. Flowers white in dense many flowered axillary spikes. Fruit a short pod, bearing usually a single seed.

Plains and prairies of western Texas and Mexico.

SOPHORA L. The Coral Beans.

Trees or shrubs with evenly pinnate leaves, showy flowers in clusters, and usually indehiscent constricted pods.

Leaves deciduous..... 1. S. affinis.
Leaves thick, persistent..... 2. S. secundiflora.

1. Sophora affinis Torrey and Gray. Deciduous Coral Bean. A small round topped tree with thin, reddish brown

Fig. 37. Sophora secundiflora.

bark and green twigs. Leaves deciduous, unequally pinnate, leaflets 11 to 19, stalked. Flowers in axillary drooping ra-

cemes. Fruit a black, shining, indehiscent pod constricted between the seeds.

On limestone hills, valley of the Arkansas River to the San Antonio and westward to the upper Colorado River.

2. Sophora secundiflora Dec. Evergreen Coral Bean. Mountain Laurel. A small narrow topped tree 15°-20° or a shrub with upright branches, and velvety twigs which become smooth with age. Leaves evenly pinnate, persistent, leaflets leathery 7 to 13. Flowers in terminl racemes, violet blue, fragrant. Fruit a hard, woody, indehiscent pod much constricted between the seeds.

Matagorda Bay to New Mexico and Mexico. Common on limestone cliffs. Planted for ornament.

ROBINIA L. The Locusts.

Trees or shrubs with alternate unequally pinnate leaves, prickly spines, flowers in drooping axillary racemes, and flat dehiscent pods, winged on one edge.

Flowers white..... 1. R. Pseudacacia.
Flowers rose colored..... 2. R. Neo Mexicana.

1. Robinia pseudceacia L. Locust. A rather large, slender tree 70°-80° high with ascending branches, and deeply furrowed, reddish brown bark. Leaves unequally pinnate, leaflets 7-19. Flowers in loose racemes, white with a yellow spot on the standard, fragrant. Fruit a dehiscent, slightly curved, reddish brown, flat pod.

An eastern tree introduced into our area.

2. Robinia Neo Mexicana Gray. New Mexico Locust. A small tree or shrub 20°-25° high with ascending branches, thin, scaly bark and almost straight spines. Leaves unequally pinnate, leaflets 10 to 15. Flowers in rather dense axillary racemes, rose colored. Fruit a dehiscent flat, leathery, light brown pod.

New Mexico, Arizona, Colorado and extending in Texas to the Pecos River Valley.

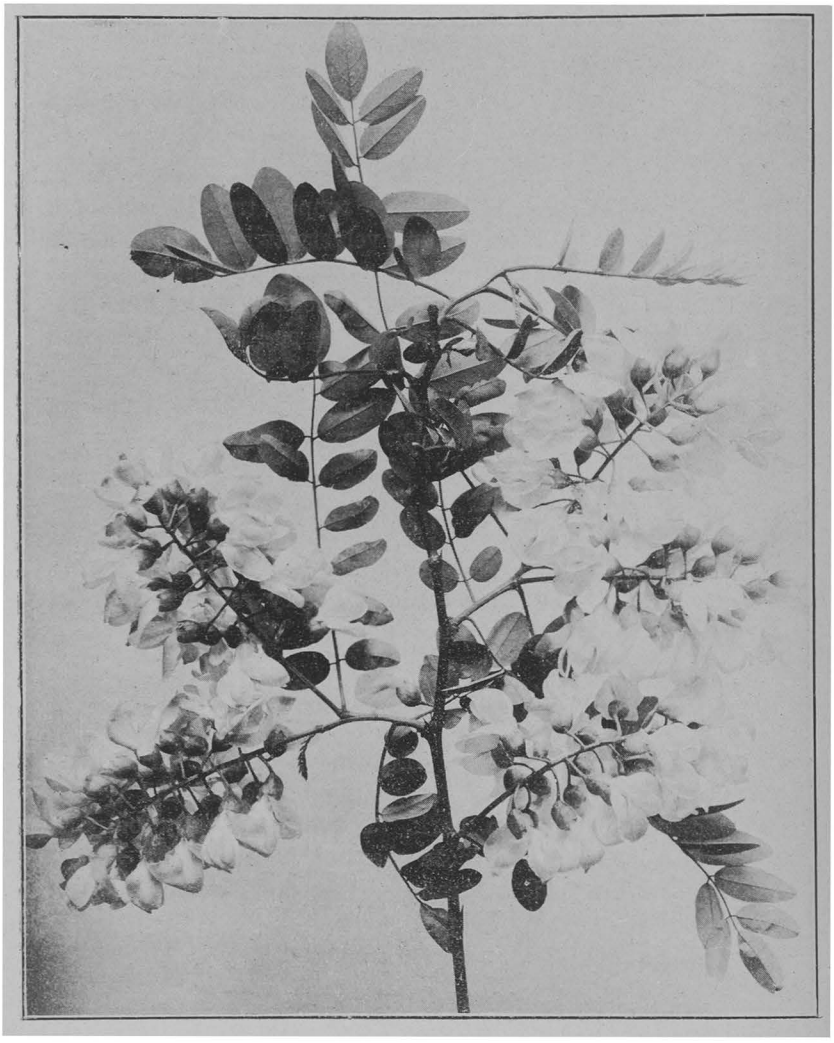


Fig. 38. Robinis pseudocacia.

COURSETIA De Condolle.

1. **Coursetia axillaris.** Coulter and Rose. A small tree or shrub with unarmed zigzag twigs and smooth bark. **Leaves** unequally pinnate, leaflets 7 to 11. Flowers white, in few

flowered racemes, or solitary. Fruit a narrow linear, smooth pod constricted between the seeds.

Near San Diego, Texas.

ZYGOPHYLLACEAE Lindley. The Caltrop Family.

Porleira Ruiz and Pavon.

1. Porleira augustifolia (Engelman) A. Gray. A small straggling tree or shrub with smooth branches, leaves opposite, evenly pinnate, leaflets 4 to 6 pairs. Flowers purple, borne on short branches. Fruit a 2-lobed or 4-lobed capsule.

On plains and prairies of western Texas and Mexico.

KOEBERLINIACEAE Engler. The Junco Family.

Koeberlinia Zuccarini.

1. Koeberlinia spinosa Zuccarini. A small, low, round topped, thorny tree with reddish brown bark and light green twigs. Leaves alternate, scale-like, soon deciduous. Flowers small, perfect in short racemes at the ends of branchlets. Fruit a globose black berry with thin flesh and one to several seeds.

RUTACEAE Juss. Rue Family.

Aromatic trees or shrubs with simple or pinnate leaves borne alternate to opposite, mostly regular, perfect flowers in compound clusters. Fruit a capsule, berry samara or drupe.

Fruit a dehiscent capsule, 1 to 2 seeded..... 1. Fagara.
Fruit an indehiscent samara.
Samara 3 to 4 winged, leaves evergreen..... 2. Helietta.
Samara with one wing surrounding the seed.. 3. Ptelea.

FAGARA L. Prickly Ash.

Trees with alternate unequally pinnate leaves, small, white, polygamous flowers in terminal or axillary clusters, and corky ridged bark.

Flowers terminal, leaves deciduous..... 1. F. Clava-Herculis.
Flowers axillary, leaves evergreen..... 2. F. Fagara.

1. Fagara Clava-Herculis (L.) Small. Prickly Ash. Toothache Tree. A small round topped tree 25°-30° high with

armed branches, thin light gray bark which bears numerous conic cork based prickles. Leaves deciduous, alternate, unequally pinnate, leaflets 7-19, taper pointed and shallowly toothed. Flowers in terminal panicles, dioecious. Fruit globose capsules borne in dense clusters.

Virginia to Florida and extending along the coast to Texas, and north to Arkansas.

2. **Fagara Fagara** (L.) Small. Wild Lime. A shrub or small evergreen tree 25°-30° high, with thin gray cork ridged bark, and thorny branches. Leaves evergreen, unequally pinnate; leaflets 5-11, sessile with axis between the leaflets winged. Flowers yellowish in axillary cymes. Fruit an ovoid, rough capsule.

A tropical species found in our area from Matagorda Bay to the Rio Grande River.

HELIETTA. Tulasne.

1. **Helietta parviflora** Bentham. A shrub or small tree 20°-25° high with erect slender trunk, ascending branches, and thin brown bark. Leaves evergreen, small, trifoliate; leaflets sessile, leathery, obovate. Flowers in axillary cymes. Fruit a samara, with wing divided into 3-4 parts.

A Mexican species extending into our area at Rio Grande City.

PTELEA L. Hop Tree.

1. **Ptelea trifoliata** L. Hop Tree. Wafer Ash. A shrub or sometimes a small round topped tree 20° high with smooth, gray, bitter bark. Leaves deciduous, alternate, trifoliate; leaflets sessile, taper pointed, strong scented when bruised. Flowers greenish white in terminal cymes. Fruit a 2-seeded broad winged samara.

Ontario to Florida, Minnesota, Texas, New Mexico, Colorado and northern Mexico. There is a wide range of variability in the shape and size of the leaves of the species. Frequently cultivated for ornament.

Fig. 39. Ptelea trifoliata.

SIMARUBACEAE De Condolle.

Ailanthus Desfontaines.

1. **Ailanthus glandulosa** Desf. Tree of Heaven. A large rapidly growing tree with thin pale bark, marked with large lenticels. Leaves large, unequally pinnate, ill-scented, leaflets 13-41, short stalked, pointed, notched at base with green glands on the under side of the teeth. Flowers greenish white in large panicels. Fruit a linear, curved samara with the seed in the middle. A chinese tree naturalized and frequently planted for ornament. It sprouts freely from the roots and becomes a pest in some localities.

MELIACEAE Ventenat. The Mahogany Family.

Melia L. China Tree.

Trees with alternate mostly bipinnate leaves, perfect flowers in much branched, axillary panicles and large clusters of globose yellow drupes which remain on the tree after the leaves have fallen.

1. **Melia Azedarach** L. China Tree. Pride of India. A medium sized tree 40°-50° high with smooth twigs and furrowed bark. Leaves large, sometimes thrice pinnate; leaflets notched. Flowers purple in large axillary panicles. Fruit remains on the tree throughout the winter. The seeds are scattered by birds. Robins are said to "get drunk" from eating the fruit.

A native of China naturalized in our area, and frequently found growing spontaneously. It is much planted for shade and ornament.

2. **Melia Azedarach umbreculifera** Sarg. Umbrella China. Similar to Melia Azedarach but with depressed umbrella-like top. Very extensively planted for shade.

SPONDIACEAE Kunth. Sumac Family.

Shrubs or small trees with resinous or milky juice; alternate, single or compound pinnate leaves; mostly dioecious flowers borne in axillary, lateral or terminal spikes or racemes, and dense heads of drupaceous fruits.

Leaves simple..... 1. Cotinus.
Leaves pinnately compound..... 2. Schmaltzia.

COTINUS Adams.

1. **Cotinus cotinoides** (Nutt.) Britton. Smoke Tree. A shrub or small tree with spreading, drooping branches, purple twigs, and light gray furrowed bark. Leaves simple, alternate, oval or obovate, 2′-6′ long, entire or with undulate margins, dark green above, paler below. Flowers in few flowered plumose panicles, at the ends of branches, staminate and pistillate borne on different trees. Fruit a drupe.

Missouri, Tennessee, Alabama and Texas. Cultivated for ornament.

SCHMALTZIA Desv. Sumac.

1. Schmaltzia copallina (L.) Small. Dwarf Sumac. Usually a shrub, but sometimes a small tree with velvety twigs and reddish brown bark. Leaves alternate, unequally pinnate; leaflets 9-21, sessile, ovate to oblong-lanceolate, the axis

Fig. 40. Melia Azedarach umbraculifera.

of the leaf winged. Flowers terminal in dense panicles, the staminate and pistillate on different trees. Fruit bright red drupes in clusters. Ornamental.

2. Schmaltzia lanceolata (Asa Gray) Britton. Closely resembles S. copallina and sometimes becomes a small tree. Its leaflets are short stalked, narrowly lanceolate, pointed at the apex and somewhat curved.

Found only in Texas, principally on limestone soil.

CYRILLACEAE Lindley. The Titi Family.

Cyrilla L.

Cyrilla racemiflora (L.) Titi. Leatherwood. A shrub or small tree 30°-35° high with thin, pale or whitish bark and reddish brown smooth twigs. Leaves alternate, deciduous, simple, obovate to oblanceolate, 2′-3′ long, ¼′-1′ wide, leathery with entire margins. Flowers small white or pink in clusters of many elongated racemes. Fruit a blunt ovoid capsule.

In swampy places and along streams. Virginia to Florida and eastern Texas.

AQUIFOLIACEAE De Condolle.

Ilex L. The Hollies. Shrubs or trees with alternate, simple deciduous or persistent leaves, perfect axillary flowers and showy drupaceous fruit.

1. Leaves evergreen.
   a. Leaves with spiny toothed margin..... 1. I. opaca.
   b. Leaves serrate but not spiny..... 2. I. vomitoria.
2. Leaves deciduous..... 3. I. decidua.

1. Ilex opaca Aiton. American Holly. A medium sized narrow topped tree 40°-50° high with light gray roughened bark. Leaves simple, alternate, 2′-4′ long, evergreen, stiff and leathery with spiny margin. Flowers small, in axillary cymes. Fruit a bright red drupe which persists throughout the winter. Emblematic of the Christmas season.

Maine to Florida, west to eastern Texas and extending up the Mississippi Valley to Missouri and Indiana. The wood is used for finishing wood and cabinet making.

2. Ilex vomitoria Aiton. Yaupon. A shrub or in our area a small tree with small, frequently inclined trunk and numerous, stiff branches. Leaves elliptical to elliptical-oblong, small,

sparingly crenulate, thick, glossy green above, paler below, persistent. Flowers staminate and pistillate. Fruit a small bright red globose drupe. Much prized for Christmas decora-

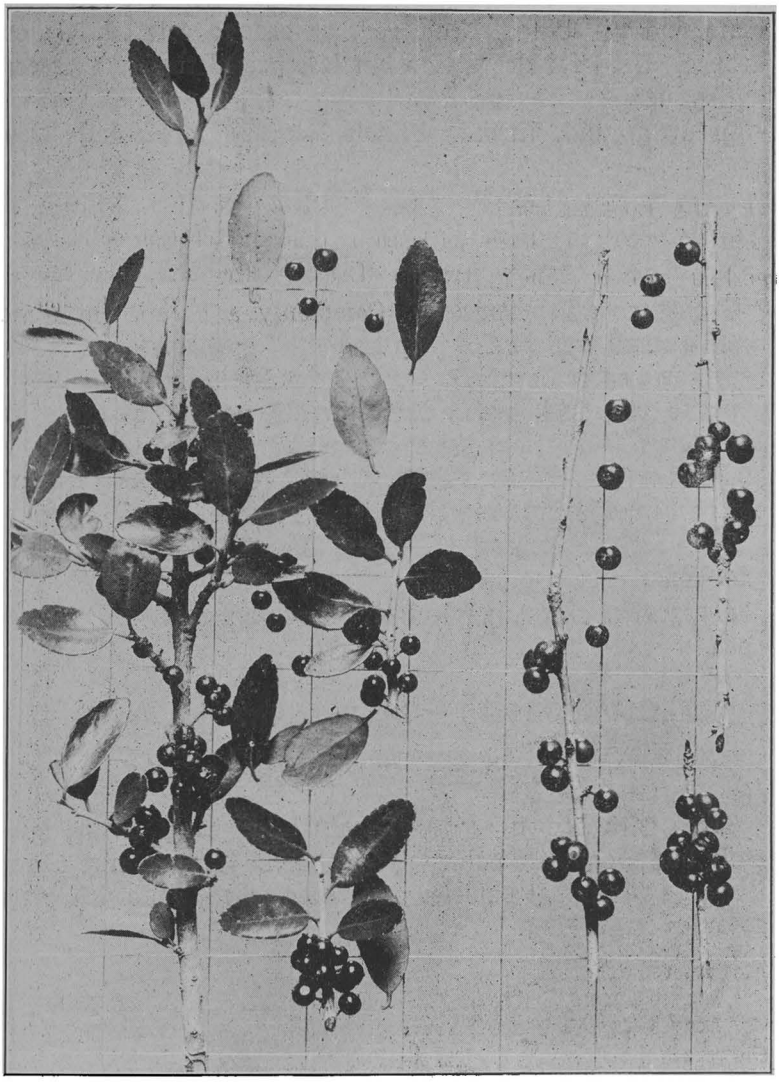


Fig. 41. Ilex vomitoria (left). Iler decidua (right).

tion. The glossy green leaves and shining red berries give to the tree a striking beauty.

Virginia to Arkansas and Texas. Cultivated for ornament.

3. Ilex decidua Walter. Deciduous Holly. A shrub or small much branched tree with thin warty bark. Leaves obovate. thick, deciduous, notched or blunt at the apex, light green, sparingly serrate, wedge-shaped at base. Flowers staminate and pistillate. Fruit red, or orange colored, globose drupes. Used for decoration but less prized than the preceding species.

In low ground, Virginia, Illinois, Kansas, Florida and Texas.

CELOSTRACEAE Lindley.

Euonymus L. Burning Bush.

Euonymus atropurpusens. Commonly a shrub, but sometimes a small tree 20′-25′ high and 4′-6′ in diameter with thin gray bark, spreading branches and slender branchlets. Leaves opposite, elliptical, ovate, finely serrate, pointed at the apex, 2′-5′ long, 1′-2′ wide, light green and smooth. Flowers in axillary cymes. Fruit a fleshy 4-lobed capsule which spreads open when ripe exposing the bright red seeds.

New York to Nebraska, Dakota, Kansas, Florida, Arkansas and Texas.

A beautiful shrub, particularly in autumn after the capsules open.

AESCULACEAE Lindley. The Buckeye Family.

Aesculus. The Buckeyes.

Trees with brown or gray, scaly bark, stout twigs, large scaly buds; opposite palmately compound leaves; large showy flowers in terminal panicles and three lobed, yellowish green capsules.

Flowers reddish.
- Leaves densely hairy beneath..... 1. A. austrina.
- Leaves smooth beneath..... 2. A. pavia.

Flowers yellowish..... 3. A. octandra.

1. Aesculus austrina Small. Southern Buckeye. A shrub or small narrow topped tree sometimes 30° high with stout branches, light brown, smooth bark and drooping branchlets.

Leaves palmately compound; leaflets usually 5, sometimes 3, short stalked, pointed at the apex, unequal at base, serrate, smooth above, hairy beneath. Flowers in terminal panicles,

Fig. 42. Aesculus pavia.

red, with tubular calyx, and stamens longer than the corolla. Fruit a pear-shaped capsule with yellowish brown seeds.

Tennessee, Missouri, Louisiana and eastern Texas. In rich soil and along rivers.

2. Aesculus pavia L. Red Buckeye. A shrub or small

tree with smooth, brown bark, and purple twigs. Leaves palmately compound, leaflets 5-7, firm, pointed at the apex, finely serrate, lustrous and smooth above, almost smooth beneath. Flowers in terminal panicles, red, with stamens as long or longer than the petals. Fruit a smooth oblong, obovate capsule with dark brown seeds.

3. Aesculus octandra Marshall. Sweet Buckeye. A large forest tree 100° high or in our area sometimes a shrub with brown, scaly bark. Leaves palmately compound with 5-7 oval to obovate or elliptic leaflets, which are short-stalked or sessile, long pointed at the apex, finely serrate, smooth above, hairy along the veins beneath. Flowers yellowish or purplish in terminal panicles. Fruit a smooth obovoid pod.

In woods and along streams, Pennsylvania, Iowa, Georgia, Louisiana and Texas. In western Texas it becomes a shrub. The tree has been extensively planted for ornament. The wood is very light.

ACERACEAE Tourn. Maple Family.

Trees with opposite, simple or pinnately compound leaves which are usually 3-5 lobed, small flowers in axillary or terminal clusters. Fruit a two winged double samara.

Leaves simple, palmately lobed twigs, reddish brown ..... Acer.
Leaves pinnate or trifoliate, twigs green or purplish ..... Rulac.

ACER (Tourn.) L. The Maples.

1. Leaves with large teeth or lobes, the margin entire.
   a. Leaves large, eastern species.
      (1) Bark on trunk gray or nearly black.. 1. A. saccharum.
      (2) Bark on trunk white..... 2. A. Floridanum.
   b. Leaves small, western trees..... 3. A. grandidentatum.
2. Leaves with 3-5 primary lobes, the margins of the lobes serrate or toothed.
   a. Leaves distinctly 5 lobed, the terminal lobe long and broadest at apex..... 4. A. saccharinum.
   b. Leaves with 3-5 shallow lobes, the terminal lobe broadest at the base.
      (1) Leaves almost or quite smooth below 5. A. rubrum.
      (2) Leaves persistently wooly below.... 6. A. Drummondi.

1. **Acer saccharum** Marshall. Sugar Maple. Hard Maple. A large round topped tree 100°-120° high with brown scaly bark, reddish brown twigs, and sugary sap. Leaves usually 3-lobed, sometimes with 5 lobes, 3′-6′ broad, long stalked, rather thin, dark green above, paler and smooth below. Flowers greenish yellow, the staminate and pistillate usually in separate clusters on the same or different trees. Fruit ripening in the late summer or autumn, wings parallel or somewhat divergent.

On uplands New Foundland to Georgia, west to Manitoba, Nebraska and Texas.

The maple sugar and sirup which are staple articles of commerce are made from the sap of this tree. The wood is very valuable, being used for flooring, finishing, and cabinet work.

2. **Acer Floridanum** (Chapman) Fox. Florida Sugar Maple. A medium sized, round topped tree with rough, chalky-white bark and light reddish brown twigs. Leaves rounded, 3-5 lobed, the notches between the lobes rounded, bark green and smooth above, hairy along the veins below. Flowers similar to Acer saccharum. Fruit a greenish 2-winged samara, the wings divergent. In lowland, Georgia, Florida, Louisiana and Texas.

3. **Acer grandidentatum** Nuttall. Mountain Sugar Maple. A small tree 30°-40° with scaly, brown bark and reddish branches. Leaves 3-lobed, the lobes with large coarse teeth, notches between the lobes broad and shallow. Flowers similar to Acer saccharum. Fruit a two winged, green samara, the wings spreading or erect.

Along mountain streams, Montana, Utah, Arizona, New Mexico, Texas and northern Mexico.

The wood is hard and close grained.

4. **Acer saccharinum** L. Silver Maple. Soft Maple. A large forest tree 100° high with short trunk and large upright branches. Bark on old stems scaly, brown; on young stems and branches, smooth light gray. Twigs reddish, curved upward at the end. Leaves deeply five lobed, the lobes sharp pointed and toothed, smooth and dark green above, pale silvery and smooth below. Flowers greenish in the axils of

the leaves of the preceding year. Staminate and pistillate flowers in separate clusters. Fruit a greenish two winged samara ripening in late spring; wings divergent. In wet

Fig. 43. Acer saccharinum.

ground, New Brunswick, Ontario, South Dakota, Florida, Oklahoma and Texas. Many cultivated varieties with finely cut leaves are planted for ornament. A very quick growing tree extensively cultivated.

5. Acer rubrum L. Red Maple. A large forest tree with upright branches. Bark on young stems gray, smooth, becoming brown and shaggy on older stems. Twigs reddish brown. Leaves 3-5 lobed, the middle lobe longer than the others and tapering toward the broad base, serrate margined, notches wide obtuse angled, medium green and smooth above, paler and somewhat hairy beneath. Flowers scarlet or yellowish, in clusters in the axils of leaves of the preceding year.

Staminate and pistillate in separate clusters. Fruit on long drooping pedicels, ripening in the spring. Wings divergent at maturity.

Most abundant on low wet ground, but sometimes found

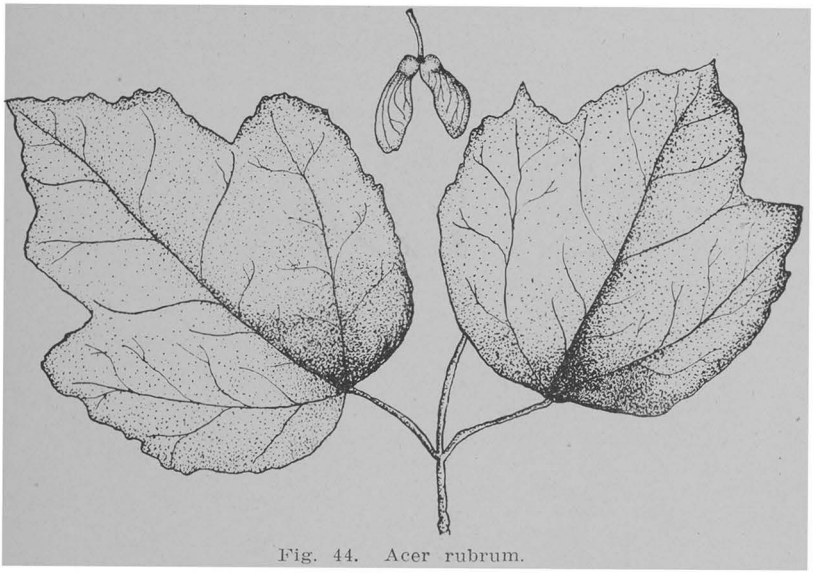


Fig. 44. Acer rubrum.

growing on hillsides. Quebec, Ontaria, Florida and west to Iowa and Texas.

The wood is used for furniture, flooring and finishing.

6. Acer Drummondi Hooker and Arnot. Drummond's Maple. A medium sized tree with whitish scaly bark. Leaves long stalked, deep green above, whitish and wooly below, 3-lobed, the lobes sharp pointed, and coarsely toothed. Flowers red, in clusters, staminate and pistillate on different trees. Fruit a two-winged samara with slender pedicel and large convergent wings.

In river swamps, Georgia, Florida and Texas.

RULAC Adams. Box Elders.

Twigs and petioles smooth..... R. Negundo.
Twigs and petioles hairy..... R. Texana.

1. Rulac Negundo (L.) A. S. Hitchcock. Box Elder. A medium sized tree with short trunk, widespreading branches,

flaky bark and smooth green twigs. Leaves pinnate, leaflets 3-5 rarely 7, coarsely and sparingly toothed, thin, light green, and smooth above, somewhat hairy along the veins below. Flowers yellowish green in drooping clusters before the leaves, the staminate and pistillate on separate trees. Fruit maturing during the summer and persistent on the branches, twigs somewhat incurved.

In lowlands, Vermont to Florida and west to the Rocky Mountains.

2. Rulac Texana (Pox.) Small. Box Elder. Similar to Rulac negundo and distinguished from it by the hairy twigs and smaller leaflets which are thick lobed.

Along streams Saskatchewan, Manitoba, Texas and Mexico.

SAPINDACEAE R. Brown. The Soapberry Family.

Trees with alternate compound, pinnate leaves. Flowers regular or irregular in large clusters. Fruit a capsule or a berry.

Fruit berry-like, flowers regular..... 1. Sapindus.
Fruit a leathery 3-lobed capsule; flowers irregular. 2. Ungnadia.

SAPINDUS L. The Soapberries.

1. Sapindus Drummondi Hooker and Arnott. Wild China. A medium sized tree 40°-50° high with upright branches and thick, fissured, flaky bark. Leaves unequally pinnate; leaflets 7-19, short stalked, unequal-sided, entire margined, smooth above, slightly hairy below. Flowers regular, whitish in large dense clusters. Fruit yellow, berry-like, persistent until spring.

Louisiana, Arkansas, Texas, New Mexico, Arizona and northern Mexico.

UNGNADIA Endlicher. Spanish Buckeye.

1. **Ungnadia speciosa** Endlicher. A small tree 25°-30° high with gray, fissured bark and slender, smooth, brown twigs. Leaves unequally pinnate; leaflets 5-7, the lateral ones sessile or almost so, the terminal ones stalked, pointed at the apex, finely serrate. Flowers pink, in large clusters, appearing

with the leaves. Fruit a long stalked 3-lobed leathery capsule which remains on the tree throughout the winter. Along streams and in canyons, Texas, New Mexico and Mexico. Planted for ornament.

FRANGULACEAE. Buckthorn Family.

Trees or shrubs with simple alternate or sometimes opposite leaves, bitter watery juice, small regular flowers and fruit either a drupe or a capsule.

Fruit fleshy with a single stone.
Petals wanting..... 1. Condalia.
Petals present..... 2. Karwinskia.
Fruit fleshy with 2-3 seed-like nutlets..... 3. Rhamnus.

CONDALIA Cavanilles. Purple Haw.

Condalia obovate Hooker. A shrub or small tree 20°-30° high with pale gray bark and spinescent twigs. Leaves small, 1′-1½′ long, and ⅓′ wide, alternate, obovate or spatulate with entire margin. Flowers small, greenish, solitary in few flowered clusters in the axils of the leaves. Fruit a blue or black oblong drupe ¼′ long with sweet flesh.

In dry soils of western Texas and northern Mexico.

KARWINSKIA Zuccarini.

Karwinski glandulosa Zucc. A small tree or shrub with smooth light brown branches and hairy twigs. Leaves opposite, 1¼′-2½′ long, firm, oval, with entire margin. Flowers small green in axillary clusters. Fruit a small subglobose black drupe.

RHAMNUS L.

Rhamnus caroliniana Walter. Indian Cherry. A shrub or small tree 30°-35° high with gray bark, and smooth reddish brown twigs. Leaves alternate, firm, oblong to elliptic, 2′-5′ long, narrow at base, smooth and shining above, paler and somewhat hairy beneath. Flowers in small clusters in the axils of the leaves. Fruit globose, bluish black with three

seeds and sweet flesh. Along streams and on hillsides, Virginia to Missouri, Kansas, Florida and Texas. Planted for ornament.

TILIACEAE Jussien. Linden Family.

Tilia L. The Bass Woods.

Trees with mucilaginous sap, tough inner bark, alternate, serrate, unequally cordate, or truncate leaves; flowers in axillary clusters with penduncles attached to a conspicuous bract; fruit nut-like.

Leaves smooth beneath..... 1. T. Americana.
Leaves more or less hairy beneath ..... 2. T. leptophylla.

1. Tilia Americana L. A large straight trunked forest tree, usually 60°-70° high with spreading branches, gray bark,

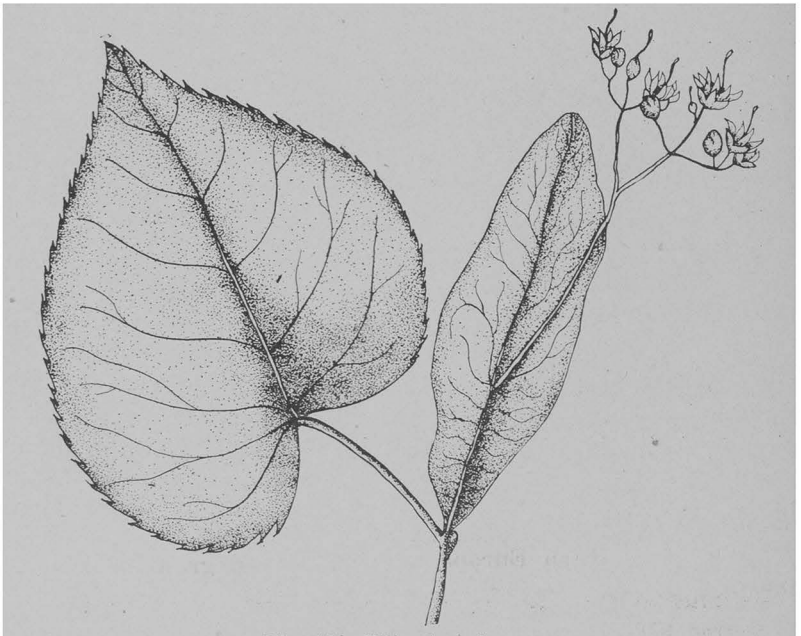


Fig. 45. Tilia Americana.

and light gray or brownish twigs. Occasionally larger, 100°-120° high. Leaves orbicular, firm, heart-shaped or truncate at base, sharply serrate, smooth dark green above, yellow-green and lustrous with hairs in the axils of the veins be-

neath. Bract rather large, the peduncle decurrent almost to the base. Fruit hairy. In woods New Brunswick to Manitoba, south to Georgia and west to North Dakota and Texas.

The wood is soft, tough, light, and is used in quantities for furniture and in carpentry. There is no merchantable supply produced in Texas.

2. Tilia leptophylla (Vant.) Small. A medium sized forest tree with smooth bark and slender twigs. Leaves thin. ovate, long pointed, toothed, smooth above, more or less hairy beneath. Bracts sessile or almost so. Fruit globose, hairy.

In Louisiana and Texas extending north to Missouri.

BUETTNERIACEAE H. B. K. Chocolate Family.

Firmiana Marsigli. Japanese Varnish Tree.

Firmiana platanifolia (L.) R. Brown. A shrub or small round topped tree 30°-35° high with smooth bark and stout green twigs. Leaves large, alternate, 3-5 lobed, smooth dark green above, hairy and paler beneath. Flowers greenish in clusters. Fruit a capsule which opens at maturity into five leathery follicles exposing the seeds.

Natives of Asia introduced into our area and planted for ornament.

TAMARICACEAE Lindley. Tamarisk Family.

Tamarix L.

Tamarix gallica L. Tamarisk. Salt Cedar. A shrub or low tree with spreading, wand-like branches and numerous branchlets. Leaves scale-like, clasping or sheathing. Flowers pink in dense plume-like clusters. Fruit a pyramidal-shaped capsule.

Native of southern Europe, introduced and growing spontaneously in our area, especially near the coast. Cultivated for ornament.

LAURACEAE Lindley. Laurel Family.

Aromatic trees or shrubs with simple, alternate, opposite

or whorled leaves. Flowers regular, usually in clusters. Fruit a drupe.

Leaves persistent, blades entire, leathery..... 1. Persea.
Leaves deciduous, some of htme lobed..... 2. Sassafras.

PERSEA Gaertner. The Red Bays.

Aromatic trees with alternate, entire, evergreen leaves. Flowers small in panicles. Fruit a subglobose drupe.

Fruit oval or pear shaped, large..... 1. Persea.
Fruit ovoid, small..... 2. Borbonia.

1. Persea persea (L.) Cockrell. Alligator Pear. A medium sized ornamental tree with thin gray bark and smooth branches. Leaves oblong to oval, smooth, reticulated beneath, margins entire. Flowers small, green in leafless clusters. Fruit a rather large drupe. Native of Central America planted for ornament in our range.

2. Persea borbonia (L.) Sprengel. Red Bay. Sweet Bay. A medium sized forest tree with thick brown, fissured bark and smooth twigs. Leaves elliptic or elliptic-oblong, entire margins, pointed at base and apex, smooth and dark green above, paler and hairy beneath. Flowers in clusters in the axils of the leaves. Fruit globular, blue or black, lustrous.

In moist soils Virginia to Florida, west to Texas and Arkansas.

The wood is bright red and is used in the manufacture of small trays, mirror frames, canes, and cupboard shelves.

SASSAFRAS Nees and Ebermeir.

Sassafras sassafras (L.) Karsten. Sassafras. A medium sized tree with thick, rough, prominently ridged, brown bark, greenish brittle twigs and mucilaginous sap. Leaves entire or 2-3 lobed, smooth, becoming red or yellow in autumn. Flowers yellow, imperfect, mostly dioecious. Fruit an oblong-globose drupe. The bark of the root yields an aromatic stimulant used in medicine.

In dry soil, Maine to Ontario, Iowa, Nebraska, Florida and Texas.

The wood is deep brown, somewhat resembling ash in its general characteristics.

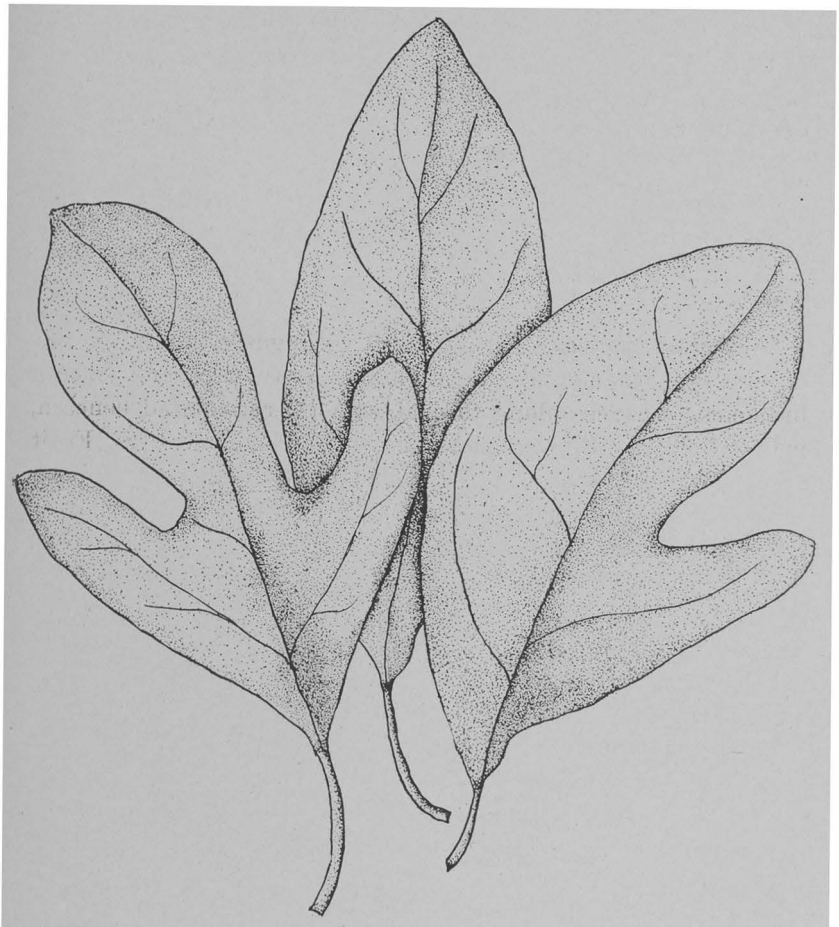


Fig. 46. Sassafras sassafras.

NYSSACEAE Dumort. Dogwood Family.

Trees or shrubs with opposite or alternate entire, firm, leathery leaves; flowers in clusters, with or without involuere; fruit a drupe rarely two seeded.

Leaves alternate..... 1. Nyssa.
Leaves opposite.
Flowers in heads, subtended by an involuere of white bracts..... 2. Cynoxylon.
Flowers not subtended by an involuere..... 3. Svida.

NYSSA (Granovius) L.

Trees with alternate, mostly entire leaves which are conspicuous for their bright red autumnal coloration. Flowers small greenish. Fruit a black drupe.

Pistillate flowers and drupes in clusters..... 1. N. sylvatica.
Pistillate flowers and drupes borne singly..... 2. N. aquatica.

1. **Nyssa Slyvatica** Marshal. Sour Gum. A large forest tree 80°-100° high with spreading slender branches, greenish

Fig. 47. Nyssa sylvatica.

yellow twigs, and dark brown, deeply furrowed bark. Leaves oval to obovate, rounded at the base, 5′-7′ long, 2′-4′ wide, somewhat pointed at the apex, mostly entire margined, smooth and lustrous above, paler and slightly hairy beneath. Flowers dioecious, the staminate in dense clusters, the pistillate in clusters of three. Fruit in clusters of three, dark blue, with acrid bitter flesh.

In moist places Maine to Ontario, Michigan, Florida, and extending to the valley of the Brazos in Texas. The wood is soft, weak, close grained, used for box boards.

2. Nyssa aquatica (L.). Gum. A large, narrow topped tree with dark brown, fissured bark and reddish brown twigs. Leaves thick, firm, ovate to elliptic, pointed at the apex, entire or with angular teeth on the margin, dark green and lustrous above, paler and hairy beneath. Flowers dioecious, the staminate in clusters, the pistillate solitary. Fruit a purple drupe.

In swampy places Virginia to Missouri, Florida and Texas. In Texas it extends to the valley of the Nueces River.

SVIDA Ofiz. Cornel. Dogwood.

Svida stricta (Lam.) Small. Stiff Cornel. Usually a shrub but sometimes a small tree with stiff ascending branches, thin gray bark and reddish twigs. Leaves opposite, elliptic, oval to ovate, long pointed at the apex mostly entire, margined somewhat hairy on both sides. Flowers perfect in terminal clusters. Fruit a pale blue subglobose drupe.

In swampy places Virginia to Missouri, Florida and Texas.

CYNOXYLON Rafinesque.

1. Cynoxylon floridum (L.) Raf. Flowering Dogwood. A small round topped bushy tree, 15°-25° high with dark scaly bark, reddish gray branches. Leaves elliptic to oval, 3′-6′ long, 1½′-2′ wide, with prominent curved primary veins, hairy on both sides, pointed at the apex. Flowers in dense clusters, surrounded by a showy involuere consisting of four white bracts. Fruit ovoid red drupes borne in clusters.

In woods, Massachusetts to Ontario and Missouri south to Florida, Texas and Mexico. A very popular ornamental tree throughout its range.

ERICACEAE De Condolle. The Heath Family.

Arbutus (Tournefort) L. Madrona.

Arbutus texana Buckley. Texan Madrona. A shrub or small evergreen tree 20° high with short, much branched trunk, furrowed, brown bark and red twigs. Leaves ovate to oblong, 1′-3′ long, 2/3′-1½′ wide, thick, and mostly entire or

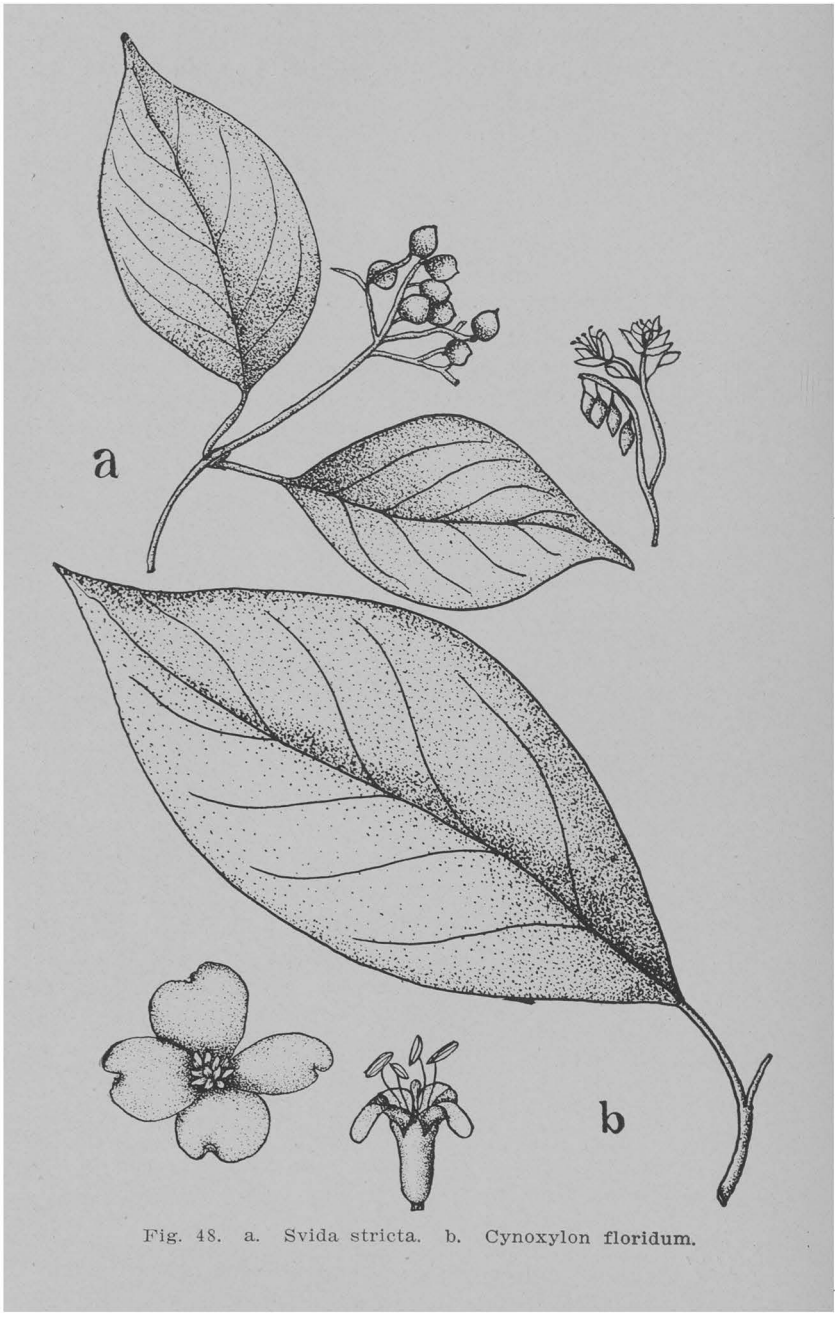


Fig. 48. a. Svida stricta. b. Cynoxylon floridum.

with scattered teeth, dark green and lustrous above, pale and slightly hairy beneath. Flowers in terminal panicles in the early spring. Fruit dark red, ripening in summer, ⅓′ in diameter with thin flesh and numerous seeds.

Western Texas and northern Mexico.

HEDERACEAE L. Ivy Family.

Aralia L. Hercules Club.

Aralia spinosa L. A prickly shrub or small tree with thin brown bark and stout twigs. Leaves alternate, large, twice or thrice pinnate, with numerous leaflets. Flowers small, white in large clusters. Fruit an ovoid, 5-lobed, black berry.

In woods and low grounds, New York to Missouri, south to Florida and Texas. Occasionally planted for ornament.

VACCINIACEAE Lindley. Huckleberry Family.

Batodendron Nuttall.

Batodendron arboreum (Marshall) Nuttall. Tree Huckleberry. A shrub or much branched small tree with thin, close, red-brown bark and smooth, red twigs. Leaves alternate, 1′-2′ long, thin, leathery, entire or with glandular teeth, dark green above, paler beneath. Flowers bell-shaped, white or pinkish, in clusters. Fruit subglobose berries with many seeds and dry astringent flesh.

In sandy soil and pine woods, North Carolina, Florida and Texas.

EBENACEAE Ventenat. Ebony Family.

Trees or shrubs with watery juice, simple, alternate, entire leaves. Flowers dioecious or perfect. Fruit a one to several seeded berry.

Bark smooth, fruit black..... 1. Brayodendron.
Bark divided into fine blocks, fruit orange colored.. 2. Diospyros.

BRAYODENDRON Small. Mexican Persimmon.

Brayodendron Texana Small. A much branched shrub or small tree 25°-35° high with smooth gray bark which peels

off in layers. Leaves small, ½′-2′ long, leathery, entire, dark green above, pale and hairy beneath. Flowers dioecious in clusters or solitary. Fruit a globose, black berry ¾′ in diameter, with sweet flesh, and everal flattened seeds.

In river valleys Texas and Mexico. The wood is mostly heart wood, variable in color. It is used for tool handles, curtain rings, furniture, pen holders, picture frames and canes.

DIOSPYROS L. Persimmon.

Diospyros Virginiana L. A medium sized forest tree 40°-50° high with spreading branches and thick, dark bark which is broken into numerous small blocks. Leaves ovate to oval, smooth, pointed, dark green above, paler beneath. Flowers yellowish green, dioecious, the staminate and pistillate borne on separate trees. Fruit fleshy, orange colored, one seeded, very astringent when green, sweet and edible when ripe.

In woods Connecticut to Iowa, Florida and Texas. The heart wood is dark, the sap white. Sometimes used for mallets and gavels.

SAPOTACEAE Reichenbach. The Sapodilla Family.

Bumelia Swartz. The Bumelias.

Shrubs or trees with milky sap, entire mostly alternate, or fasicled leaves and perfect axillary flowers. Fruit a fleshy black drupe with one seed.

1. Leaves smooth or almost so beneath.
   a. Leaves persistent..... 1. B. angustifolia.
   b. Leaves deciduous.
      (1) Leaves prominently net veined..... 2. B. lucida.
      (2) Leaves not prominently net veined.... 3. B. lycioides.
2. Leaves densely hairy beneath.
   a. Leaves small wedge shaped at base..... 4. B. rigida.
   b. Leaves larger 2'-4' long, not wedge shaped.. 5. B. lanuginosa.

1. Bumelia angustifolia Nuttall. Saffron Plum. A small evergreen tree 20° high with reddish gray, fissured bark and spinescent branchlets. Leaves obovate or oblanceolate-spatulate, entire, leathery, persistent for about two years, 1′-1½′

long, ¼′-1¼′ wide. Flowers in the autumn in few or many flowered fasicles. Fruit oblong, black, ripening in the spring.

Florida and the Keys and also in the Rio Grande Valley, Texas and Mexico. The wood is heavy, coarse grained, not strong, light brown, or orange colored.

2. Bumelia lucida Small. Shining Bumelia. A small tree 20°-30° high with stiff thorny branches and smooth bark. Leaves elliptic pointed or blunt at the apex, 1′-2′ long, leathery, entire, smooth, dark green and lustrous above, paler and with prominent netted veins beneath. Fasicles many flowered. Fruit mostly oval.

In woods of Louisiana and eastern Texas.

3. Bumelia lycioides (L.) Gaertner. Southern Buckthorn. A small tree 25°-30° high with short trunk, stout branches, and thin, grayish, smooth bark. Leaves oblong elliptic, 1½′-4′ long, ½′-1½′ wide, leathery, mostly pointed at the apex, tapering at base, pale green with prominent netted veins. Flowers in many flowered fasicles appearing in the spring. Fruit an oval berry, ripening in the autumn. Illinois south to Florida and Texas. Wood heavy, hard, weak, close grained, brown or yellow.

4. Bumelia rigida (A. Gray) Small. Arizona Buckthorn. A small tree 25° high with short trunk, flaky, red brown bark and stout stiff thorny branches. Leaves thick, leathery, 1′ long, ¼′ wide, cuneate or oblong, smooth above, wooly beneath. Flowers in few flowered fasicles. Fruit oblong-oval to oval, black.

Along streams Texas to Arizona and northern Mexico. Wood hard, close grained, weak, brown or yellow.

Texas, Arizona, and Northern Mexico.

5. Bumelia lanuginosa (Michaux) Persoon. Wooly Buckthorn. A medium sized tree 50°-60° high with straight trunk, fissured bark, and short stiff branches. Leaves oblong-ovate or wedge-obovate, 1′-2½′ long, ⅓′-¾′ wide, entire margined, dull dark green above, rusty wooly beneath. Flowers in fasicles of 16-18. Fruit oval, obovoid-oblong, black with thick flesh.

Missouri, Kansas, Florida, and Texas. Wood heavy, weak,

close grained, yellow or brown. A gum exudes from freshly cut wood.

STYRACEAE A. De Condolle. The Storax Family.

Mohrodendron Britton. Silverbells.

Trees or shrubs with alternate, membranous, deciduous leaves, flowers in lateral drooping clusters and dry nut-like fruit, 2-4 winged.

Fruit 2-winged..... 1. M. dipterum.
Fruit 4-winged..... 2. M. Carolinum.

1. Mohrodendron dipterum (Ellis) Britton. Snowdrop Tree. A shrub or small tree 20°-30° high with scaly, reddish brown bark and light green twigs which finally become reddish brown. Leaves firm, ovate to obovate, pointed at the apex, 4′-5′ long, 1½′-3′ wide, coarsely toothed, light green and smooth above except along the veins, hairy beneath. Flowers white, showy, in clusters. Fruit an oblong or elliptic, 2-winged drupe.

In moist places, Tennessee, South Carolina, Florida and Texas. Frequently planted for ornament.

2. Mohrodendron Carolinum (L.) Britton. Silverbell Tree. A shrub or small tree with ascending branches and reddish brown scaly bark. Leaves thin, oval to obovate, pointed at the apex, finely toothed, smooth above except along veins, 4′-6′ long, 2′-3′ wide, hairy beneath. Flowers white, showy, bell-shaped in clusters. Fruit an oblong ovoid drupe, 4 winged.

In woods, Virginia to Illinois, Florida and Texas. Planted for ornament.

OLEACEAE Lindley. The Olive Family.

Trees or shrubs with mostly opposite, simple or compound leaves. Flowers in clusters, perfect or dioecious. Fruit a samara or a drupe.

Fruit a dry samara, leaves compound..... 1. Fraxinus.
Fruit fleshy, leaves simple.
  Flowers white, showy..... 2. Chionanthus.
  Flowers greenish, small..... 3. Adelia.

FRAXINUS (Tourn.) L. Ash.

Trees with opposite, odd pinnate leaves, and furrowed bark; flowers in axillary clusters, and staminate and pistillate on different trees: fruit a samara.

1. Petioles and leaf rachis winged..... 1. F. Greggii.
2. Petioles and leaf rachis not winged.
   (1) Lateral leaflets sessile or short stalked.... 2. F. velutina.
   (2) Lateral leaflets distinctly stalked.
      a. Shoots and main axis of leaf hairy or velvety ..... 3. F. Pennsylvania.
      b. Shoots and main axis of leaf smooth.
         (a) Wing of the fruit extending down on the body almost to the base.
            x. Body of the fruit flattened.
               m. Leaflets 5-7..... 4. F. Caroliniana.
               n. Leaflets 3-7..... 5. F. cuspidate.
            y. Body of the fruit round or nearly so.
               m. Leaflets 3-5..... 6. F. Berlandieri.
               n. Leaflets 5-7..... 7. F. Toumeyi.
         (b) Wing of the fruit terminal or nearly so.
            x. Leaflets mostly 5 sometimes 7.. 8. F. Texensis.
            y. Leaflets 5-9 mostly 7..... 9. F. Americana.

1. Fraxinus Greggi Gray. Gregg's Ash. A small tree 20°-25° high with thin, gray, scaly bark and smooth twigs. Leaves with petiole and rachis winged, leaflets 3-7, sessile. Fruit in small clusters in the axils of leaves. On dry limestone cliffs western Texas and northern Mexico.

2. Fraxinus velutina Torrey. Velvety Ash. A round topped tree 30°-40° high and 6′-8′ in diameter with stout spreading branches, rough, reddish green bark, and velvety twigs. Leaves unequally pinnate, velvety on lower surface; leaflets 3-9, lanceolate to ovate, sessile, yellowish green, leathery. Flowers dioecious, the staminate and pistillate on different trees. Seed of the samara round, the wing extending down only about one-fourth of the length of the seed. Western Texas, New Mexico, Arizona, Nevada and southern California.

3. Fraxinus Pennsylvanica Marshall. Red Ash. A medium sized tree 50°-60° high with dense crown, brown fis-

sured bark and hairy twigs. Leaves unequally pinnate; leaflets 5-9, usually 7, stalked, margin entire or somewhat toothed, pointed at the apex, yellowish green on both surfaces, paler beneath than above. Flowers dioecious, appearing with the leaves. Fruit linear to spatulate, the wing extending down on the body to the middle or below. In rich moist soils, New Brunswick, Ontario, Nebraska south to Florida and west to Texas. The wood is used for agricultural implements and vehicles. The tree is frequently planted along streets and in parks, for which purpose it is well suited.

4. Fraxinus Caroliniana Miller. Water Ash. Swamp Ash. A round topped tree 40° high with thin gray bark and smooth branches. Leaves unequally pinnate, hairy at first, becoming smooth with age; leaflets 5-7 rarely 9, ovate or oblong, stalked, coarsely serrate, dark green above, paler and sometimes hairy beneath. Flowers dioecious, on different trees. Samara elliptic to ovate, body linear, flat, frequently 3-winged. In moist soil and swampy places, Virginia to Florida and west to the valley of the Sabine River, Texas. The wood is soft and weak and has no commercial value.

5. Fraxinus cuspidata Torrey. American Flowering Ash. A small stout tree 20° high with gray bark, smooth twigs. Leaves with 3-5 or 7 leaflets; leaflets ovate to narrowly lanceolate, entire or serrate, pointed, dark green above, paler beneath. Flowers perfect in clusters. Samara flat with short wing. In rocky soil and canyons western Texas, Arizona and northern Mexico. One of the ornamental trees of Mexico.

6. Fraxinus Berlandieri de Candolle. Berlandier's Ash. A small tree not over 30° high, with rough gray bark and smooth twigs. Leaves unequally pinnate, smooth or with rusty colored hairs along the veins beneath; leaflets 3-5, stalked, lanceolate to oblong, dark green above, light green beneath. Flowers dioecious, in clusters. Fruit flattened, with the wing twice as long as body, and extending down upon it below the middle. Southwestern Texas and northern Mexico. An ornamental tree of Mexico, and possibly not native to Texas.

7. Fraxinus Toumeyi Britton.. Toummey's Ash. A small tree rarely 40° high with rough, gray bark and smooth or

velvety twigs. Leaves unequally pinnate, smooth or velvety below; leaflets 5-7, long pointed, toothed or entire, stalked, yellowish green above, paler beneath. Flowers dioecious. Fruit small, the wing extending down on the round body almost to the middle. In canyons and river valleys, western Texas, New Mexico and southern California. Planted for shade and ornament.

8. **Fraxinus Texensis** (Gray) Sargent. Texas Ash. Mountain Ash. A medium sized tree reaching a height of 50° with thick trunk, spreading branches and dark gray, deeply fissured bark. Leaves with 5-7 ovate stalked leaflets which are entire or toothed, dark green above, pale beneath. Flowers dioecious, appearing in spring with the leaves. Fruit small, the wing as long or longer than the seed bearing portion and terminal upon it. On bluffs and hillsides central and western Texas.

9. **Fraxinus Americana** L. White Ash. A large tree sometimes reaching 120° in height and 5°-6° in diameter with upright or spreading branches, deeply fissured gray bark, and smooth twigs. Leaves unequally pinnate with 5-9, usually 7, leaflets; leaflets ovate to oblong, entire or somewhat toothed toward the apex, usually long pointed, deep green and smooth above, paler and usually silvery beneath. Flowers dioecious. Fruit ripens in early fall; body round, plump, the wing 2-3 times as long as the body, and terminal upon it.

Rich soil Nova Scotia to Minnesota and south to Florida, Kansas, and Texas. The wood is heavy, hard, strong, tough, close grained. One of the most valuable of the hard woods; used for agricultural implements, handles, furniture, vehicle stock and house finishing. The tree is planted for street and shade throughout its range.

ADELIA P. Br.

Adelia acuminita Michx. Crooked Bush. A shrub or small tree 20° high with many crooked, slender branches and smooth bark. Leaves simple, opposite, deciduous, elliptic-oval or ovate elliptic, 1¼′-3½′ long, pointed at base and apex, slightly serrate. Flowers appearing before the leaves,

dioecious, yellowish or greenish, in clusters. Fruit a deep purple, oblong drupe, ¼′-½′ long.

On river banks and moist soil, Illinois, Missouri, Georgia and Texas. Usually a shrub and frequently planted for ornament. It can be trained to form a beautiful hedge.

CHIONANTHUS L.

Chionanthus Virginica L. Fringe Tree. Old Man's Beard. A shrub or small tree 30° high with short trunk, ascending branches, and reddish brown, scaly bark. Leaves opposite, simple, oval, ovate or oblong elliptic, thick, entire margined, pointed at the apex, bright green and smooth above, paler and hairy along the veins below, 2′ to 6′ long. Flowers in axillary clusters, corolla white, the petals long, linear, fringe-like. Fruit a dark purple drupe ½′ long. In rocky soil, Pennsylvania, Florida and Texas. The wood is close grained, light brown in color. Frequently planted for ornament in parks and lawns.

EHRETIACEAE Schrad. Ehretia Family.

Trees or shrubs with alternate leaves, watery sap, simple entire leaves and perfect flowers in compound cymes.

Leaves 3'-5' long..... 1. Cordia.
Leaves 1'-2' long..... 2. Ehretia.

CORDIA L.

Cordia Boissieri A. De Condolle. A small round topped, aromatic, evergreen tree 25° high with gray, ridged bark and stout twigs covered with rusty hair. Leaves ovate or oblong-ovate, 3′-5′ long, entire or undulate margined, dark green, rough above, with brownish velvety hairs beneath. Flowers showy in clusters; corolla white with yellow center, calyx densely hairy. Fruit an ovoid red-brown drupe 1′ long with sweet pulp and smooth stone.

Limestone soils Texas, New Mexico and Mexico. One of the medicinal trees of the Mexicans. The fruit is edible and

the tree is frequently planted for ornament throughout its range.

EHRETIA P. Brown.

Ehretia elliptica De Condolle. Knackaway. A medium sized round topped tree 40° high, 3° in diameter with stout branches, furrowed bark and smooth reddish brown twigs. Leaves oval to oblong, very rough above, leathery, entire margined or toothed, hairy along the veins beneath. Flowers small, white, in clusters, April and later. Fruit subglobose, the size of a pea, with thin juicy edible flesh. Western Texas and northern Mexico. The wood is hard, close grained, but not strong. One of the desirable shade and street trees of its range.

In river valleys western Texas and Mexico. Extensively planted for shade and ornament.

RHINANTHACEAE.

Paulownia Siebold and Zuccarini.

Paulownia tomentosa (Thurnberg) Boillon. A medium sized tree much resembling catalpa and frequently mistaken for it, but readily distinguishable from it by the fruit. The bark is brown and rough, branches stiff, ascending. Leaves large, entire or three lobed, smooth above, slightly hairy beneath with two prominent glands at the base. Flowers large, showy, violet, opening before the leaves. Fruit a large leathery capsule with winged seed.

Native of Japan and China but cultivated in our territory and sometimes growing spontaneously.

BIGNONIACEAE Persoon. Trumpet Creeper Family.

Trees with opposite or alternate leaves, large showy flowers in clusters, fruit an elongated capsule, seeds winged.

Leaves broad, mostly opposite..... Catalpa.
Leaves linear, alternate..... Chilopsis.

CATALPA Scopoli. The Catalpas.

Trees with opposite, simple, broad leaves, large showy

flowers in terminal clusters. Fruit a long round pod which splits into halves; seeds many with a tuft of hair at each end.

Leaves short pointed, flowers bright spotted, wings of seeds narrowed..... 1. C. Catalpa.
Leaves long pointed, flowers nearly pure white, wings of seeds long..... 2. C. speciosa.

1. Catalpa catalpa (L.) Karsten. Catalpa. Indian Bean. A short trunked, round topped tree sometimes 50°-60° high and 3°-4° in diameter with grayish-brown scaly bark. Leaves opposite, broadly ovate, heart-shaped at base, entire or with one or two lateral lobes, light green and smooth above, pale and hairy beneath, foetid when crushed, 5′-6′ long, 4′-5′ wide on rounded stalks 5′-6′ long. Flowers showy in dense many flowered clusters, corolla white, much spotted with yellow and purple. Pod thin, 6′-20′ long, splitting into two flattened halves. Seeds about 1′ long with pointed wings. Georgia, Florida, Alabama, Mississippi, and extensively naturalized west and north. It is common in many parts of Texas.

2. Catalpa speciosa Worder. Hardy Catalpa. A straight trunked tree which may reach a height of 120° and diameter of 4½°, but is usually smaller. Bark of old trees deeply fissured. Leaves opposite, entire or one to three lobed, broadly or oblong ovate, 4′-12′ long, long pointed, dark green and smooth above, lighter and hairy beneath, with clusters of dark glands in the axils of veins. Flowers showy in terminal, few flowered clusters; corolla white with few yellow spots. Pod 8′-20′ long, splitting into halves, the seeds with broad wings.

Indiana, Illinois, Missouri, Kentucky, Tennessee, Arkansas and naturalized in Louisiana and eastern Texas. Often planted for timber and ornament. The wood is durable and is used for fence posts.

CHILOPSIS D. Donn. Desert Willow.

Chilopsis linearis (Covanilles) de Condolle. Flowering Willow. Willow-leaved Catalpa. A small tree or shrub with short crooked trunk, slender branches, and ridged, scaly bark.

Leaves opposite or alternate, deciduous, linear, 6′-12′ long, ⅓′-¾′ wide. Flowers large, showy, in terminal clusters, opening for several months in succession; corolla white tinged with yellow and purple. Fruit a dry thin walled elongated capsule 7′-12′ ¼′ thick, persistent on the branches through the winter, seeds winged.

In dry soils western Texas, southern New Mexico, Arizona, Utah, Nevada, California and Mexico. Frequently planted in our area for ornament.

RUBIACEAE B. Jussien. The Madder Family.

Cephalanthus L.

Cephalanthus occidentalis L. Button Bush. A shrub or small tree reaching a height of 40°-50° and trunk diameter of one foot, but usually smaller, with gray brown bark, and stout pithy twigs. Leaves simple, opposite or whorled, ovate or lanceolate, 4′-7′ long, 1′-3½′ wide, pointed at the apex, smooth above, somewhat hairy beneath. Flowers perfect in axial or terminal globose heads. Fruit a globose head ½′-1′ in diameter.

In swamps and low borders of ponds and streams, New Brunswick, Ontario, Nebraska, Kansas, Florida, Texas, New Mexico and Arizona. Occasionally planted for ornament.

CAPRIFOLIACEAE Ventenat. Honeysuckle Family.

Trees with opposite simple or compound leaves, cymose flowers, and drupaceous fruit.

Leaves pinnately compound..... 1. Sambucus.
Leaves simple..... 2. Viburnum.

SAMBUCUS (Tournefort) L. The Elders.

1. Sambucus Mexicana Presl. Mexican Elder. A small tree 25°-30° high with light brown, scaly bark and greenish, hairy twigs which are finally brownish-red. Leaves opposite, unequally pinnate, leaflets usually 5, ovate to ovate-lanceolate, pointed at the apex, toothed, hairy when young and al-

most smooth with age. Flowers white in flat topped hairy cymes. Fruit a small black juicy drupe.

Western Texas, southern California and Mexico.

2. Sambucus canadensis L. American Elder. This species occurs from Nova Scotia to Manitoba, Florida west to Kansas and Texas. It is distinguished from the preceding by its smooth foliage and inflorescence.

VIBURNUM L.

Viburnum rudifulum Rafinesque. Black Haw. A small tree 30°-35° high with rough reddish bark and gray twigs. Leaves leathery, variable in form, elliptical-ovate or elliptical-obovate, pointed, sharply and finely serrate, dark green and lustrous above with numerous rusty brown hairs beneath. Flowers perfect in white terminal clusters. Fruit a bright blue drupe, 1/2′-2/3′ long, covered with a glaucous bloom.

Virginia, Illinois, Florida, Kansas and Texas. Occasionally cultivated.

GLOSSARY.

Achene. A dry one seeded fruit.
Acrid. Sharp, sour with unpleasant taste.
Acuminate. Tapering into a long point.
Acute. Sharp pointed.
Aerial. Growing in the air.
Ament. A spike of flowers all of one sex falling in one piece.
Anther. The enlarged portion of the stamen containing pollen.
Apex. Tip or upper end.
Appendaged. With projections.
Appressed. Lying against or close to another part.
Aromatic. Fragrant, spicy.
Ascending. Growing obliquely upward.
Astringent. Drawing together, hence puckering.
Awl-shaped. Shaped somewhat like a spine.
Axil. The angle between the upper side of the leaf petiole and the stem.
Axillary. Borne in the axil of a leaf.
Axis. The part of stem or branch which bears foliage leaves, flowers or flower parts.
Bark. The rind or outer covering of the stem.
Basal. At the base or springing from it.
Bipinnate. Doubly or twice pinnate.
Blade. The flat expanded portion of the leaf.
Bract. A more or less modified leaf found below a flower cluster.
Branch. A secondary division of a trunk.
Branchlet. One of the ultimate divisions of a branch.
Bud. An undeveloped shoot.
Bud-scales. Reduced leaves which cover the bud.
Calyx. The green saucer shaped outer part of the flower.
Capsule. A dry dehiscent fruit consisting of two or more carpels.
Carpel. A simple pistil or an element of a compound pistil.
Catkin. Same as ament.
Compound. Two or more similar parts united.
Compound leaf. Consisting of two or more leaflets borne on one stalk.
Cone. An elongated axis bearing scales which overlap each other.
Conifer. Bearing cones.
Constricted. Narrowed.
Cordate. Heart-shaped.
Corolla. The inner usually colored leaves of the flowers.
Corymb. A flat topped flower cluster in which the flowers open from the outside inward.
Crenate. Scalloped.
Cuneate. Wedge-shaped.
Cyme. A flat topped flower cluster blooming from the apex or middle first.
Deciduous. Falling off, as leaves in autumn.

Dehiscent. Splitting open as in pods.
Deltoid. Triangular. Delta-like.
Dentate. Toothed.
Dioecious. Bearing stamens and pistils on different plants.
Drupe. A fleshy fruit with one stone as the plum.
Druplet. A small drupe.
Elliptical. Oval or oblong with rounded ends.
Elongated. Long drawn out.
Entire. Without teeth, notches or lobes.
Epidermis. The outer skin or layer of plants.
Equally pinnate. Without an odd leaflet at the end of the leaf.
Exudation. Sap, resin or milk that oozes from a cut surface.
Fasicle. A close cluster of leaves or flowers.
Fasicled. Arranged in fasicles.
Feather-veined. With veins extending from the sides of the midrib.
Fertilization. The union of a male cell, derived from the pollen, with a female cell in the ovule.
Filament. The stalk which bears the anther.
Flower. An axis which bears stamens or pistils or both, with or without petals and sepals.
Fruit. A ripened ovary with or without accessory parts.
Genus. A group of species which are more like each other than like any other group.
Glabrous. Smooth.
Glaucous. With a bloom, a bluish or whitish waxy layer.
Globose. Ball-like or nearly so.
Globular. Ball-like.
Head. A dense cluster of sessile flowers.
Heartwood. The mature and dead wood of a stem usually darkly colored.
Hybrid. A cross between two different species or varieties of plants.
Imbricated. Overlapping like shingles.
Incised. Cut.
Indehiscent. Not splitting open.
Inflorescence. A flower cluster.
Involucre. The bracts which surround a flower cluster.
Irregular. Used to denote flowers in which the petals are unlike.
Keeled. Ridged like the keel of a boat.
Lanceolate. Shaped like a lance.
Leaflet. One of the ultimate divisions of a compound leaf.
Lenticel. Lenticular corky growths on the young bark.
Linear. A leaf several times as long as wide, with sides parallel or nearly so.
Lobe. A division of a simple organ as a leaf.
Lustrous. Shining.
Medullary rays. Rays extending from pith to bark.
Membranous. Papery, membrane-like.
Mid-rib. The main central rib of the leaf.

Monoecious. Stamens and pistils in different flowers on the same individual.

Nectar. The sweet secretion of the flower.

Net-veined. With veins running in various directions and connecting with each other.

Nut. A dry, hard indehiscent 1-seeded fruit with a stony shell.

Nutlet. A very small nut.

Obcordate. Reverse heart-shaped.

Oblanceolate. Lanceolate, tapering toward the base.

Oblique. Unequal, slanting.

Obovate. Egg shaped with tip downward.

Obovoid. Solid ovate with broader end toward apex.

Odd pinnate. With an odd leaflet at the end.

Opposite. On opposite sides of the stem directly across from each other.

Oval. Broadly elliptical.

Ovate. Egg shaped.

Ovoid. Solid ovate.

Ovule. An immature seed.

Palmate. Lobed or divided like the fingers of the hand.

Panicle. A loose compound flower cluster with the lower branches longer and blooming first.

Peduncle. The flower stalk.

Perfect. A flower which has both stamens and pistils.

Persistent. Leaves which remain on the branches over the first year or a calyx which remains on or under the fruit as in the hawthorn or persimmon.

Petal. One of the separate parts of the corolla.

Pinnae. The primary divisions of a bipinnate leaf.

Pinnate. A leaf which bears leaflets on both sides of a common petiole.

Pistil. The female organ of a flower, consisting of style, stigma and ovary.

Pistillate. With pistils but without stamens.

Pith. The central cellular part of a stem.

Pod. A dry fruit with one carpel which splits along two sides.

Pollen. The yellowish dust contained in the anther.

Pome. A fleshy fruit with a papery core as the apple.

Puberulent. Slightly pubescent.

Pubescent. Covered with short soft hairs.

Pyriform. Pear shaped.

Raceme. An elongated flower cluster with all the pedicels about equal in length.

Racemose. In a raceme.

Rachis. The axis of a compound leaf or of a spike.

Regular. With all the members alike in shape and size.

Reniform. Kidney shaped.

Resinous. Bearing Resin.

Reticulate. Net-like.

Samara. A winged fruit.

Scale. A minute leaf.
Sepal. One of the parts of the calyx.
Serrate. With teeth like a saw.
Sessile. Without a stalk.
Sheath. A tubular or enrolled part or organ.
Simple. Of one part.
Sinus. The opening between the lobes of a leaf.
Spatulate. Spoon shaped.
Species. A group of individuals which are more like each other than they are like any other group.
Spike. An elongated axis which bears sessile flowers.
Spine. A sharp woody outgrowth from the stem.
Stamen. The organ of the flower which bears the pollen.
Staminate. With stamens but without pistils.
Stigma. The tip of the pistil.
Stipules. A pair of leaf like organs at the insertion of the petiole.
Stomate. A breathing pore in the leaf.
Style. The filamentous portion of the pistil.
Teeth. Projections from the leaf margin.
Thorn. A reduced, sharp pointed branch.
Tomentum. A dense layer of hairs.
Trifoliate. With three leaves.
Truncate. Cut off squarely.
Umbel. A flower cluster in which all the pedicels arise from the same point.
Whorl. A group of three or more leaves or branches radiating from the point of attachment.

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